AUG 8 1921

Electrical World

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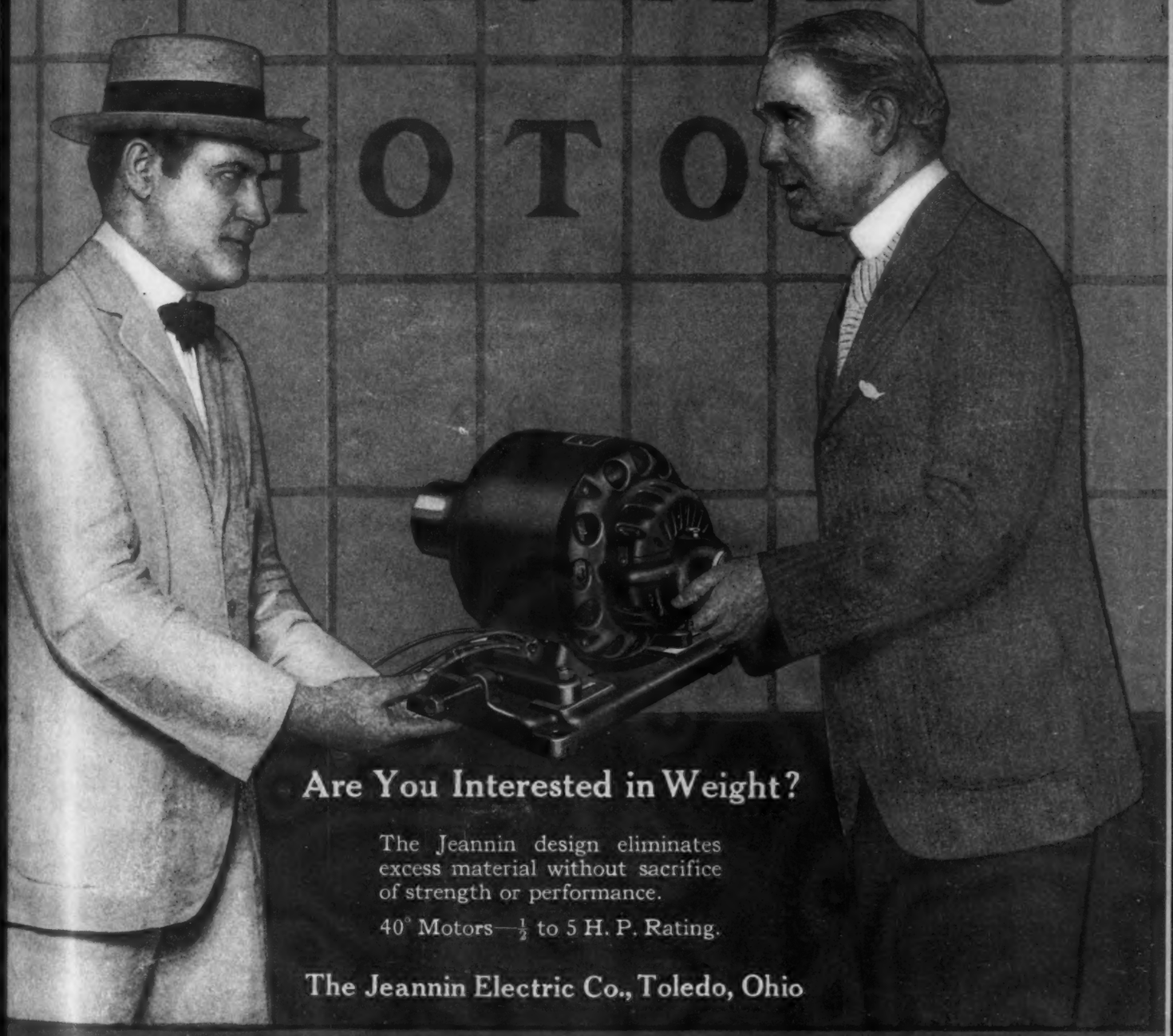

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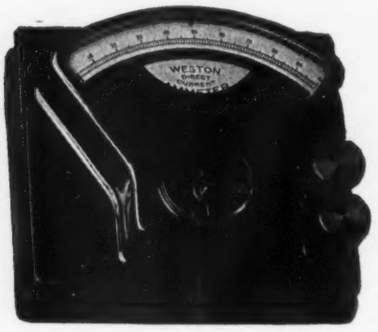

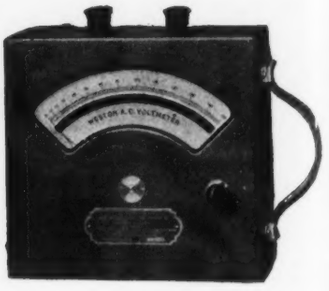

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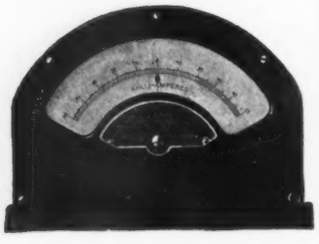
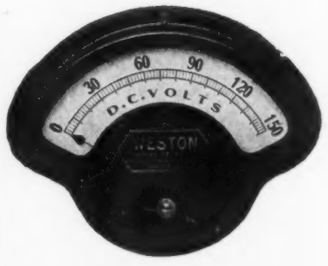




Electrical World

New York, Saturday, August 6, 1921

Why Electrical Men Will Dominate the Electrical Trade

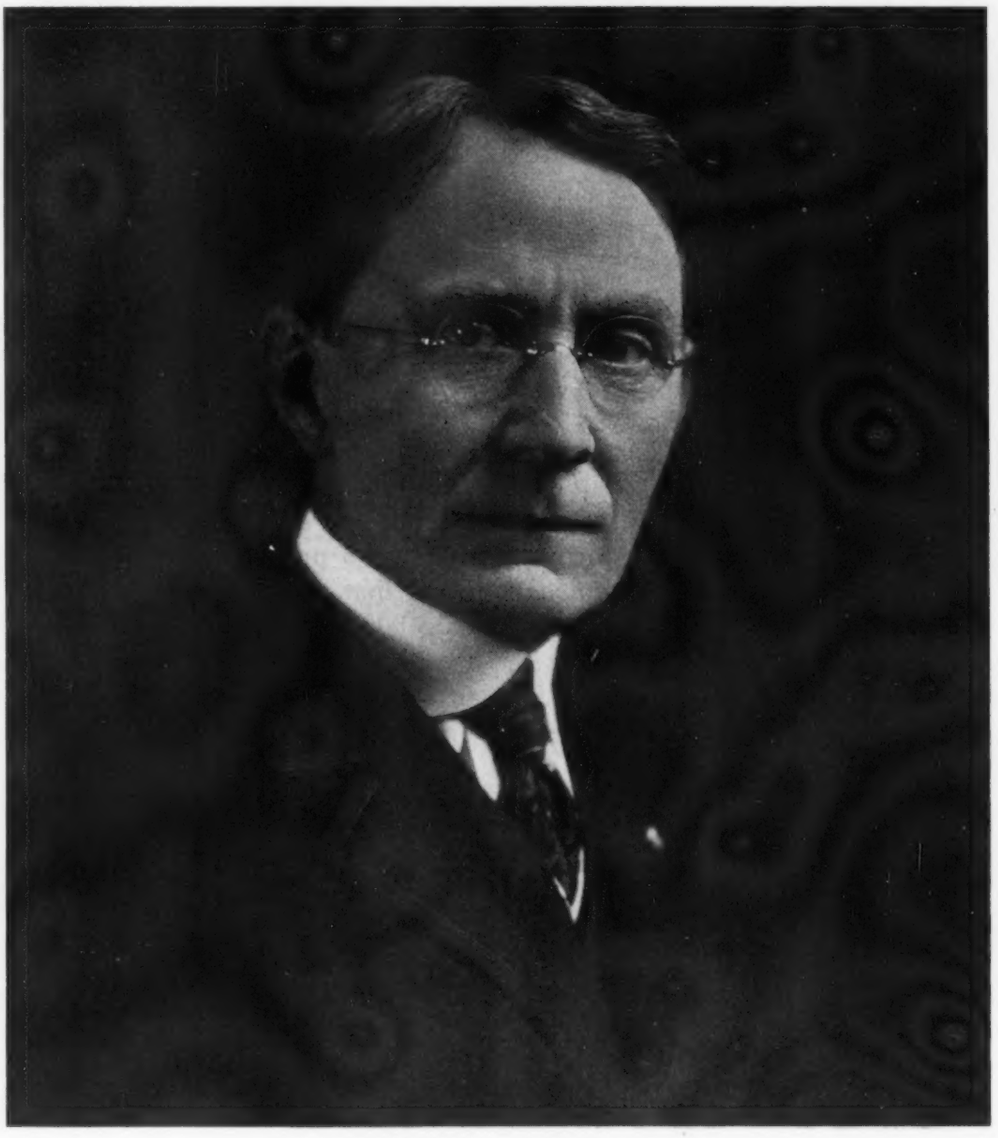
THE oft-recurring question is abroad again: *"Who is to be the electrical merchant?"* Conditions in the country just now are focusing the minds of the business-thinking men of the industry on this problem of local distribution. It is being freely discussed. Opinions differ. Yet, after all, are there not simple facts that point the answer clear?

The electrical retail merchant of today is passing through the very early stages of his evolution. Central-station electric shop managers are selling appliances. So are electrical contractors, dealers and jobbers. So are non-electrical men in hardware, drug and department stores. Each is experimenting and developing a new line, a new market, a new trade. In this new trade the ever-present basic laws of natural selection are daily at work. Out of it all will come the answer.

W. E. Robertson told the contractors in Buffalo just recently that the electrical man will be the dominant appliance merchant because he can most easily service the appliances he sells. This is sound sense, but back of it is still another reason. The electrical man will hold his leadership in this great field also because he has a better background of electrical experience linked with a clearer vision of the coming scope and power of electric service. Selling appliances to him is and will ever be more than mere merchandising. There is a purpose and a prospect in his mind that make the selling of a flatiron or a lamp mean something more to him than to a hardware man. The influence of this impelling spirit of our industry brings practical advantage.

The question as to whether the electric store in any town will be manned by a contractor or a central-station company is another issue that will unfold itself by still another process of natural selection. The best man will win—according to his talent for the merchant's trade. It matters little from which class he comes. A liking for the work will call the many. Special merchandising genius will select the few who ultimately will be leading us.

The task is now to educate and stimulate the merchants that we have and raise up bigger, more productive, more effective men for the better electric shops that are to come. The ELECTRICAL WORLD is eagerly endeavoring to help speed this gradual natural evolution by providing a practical service of trade news, news of the industry and guidance in commercial practice that must be ever an essential background of the electrical merchant's mind.



Charles Edward Skinner

Scientist of international reputation whose extensive research work, especially on insulation, has had a marked effect on the development of electrical machine design

FROM the time of the first generator there has been a constant effort to raise the quality of electrical equipment. Manufacturers have never slackened in their efforts to produce equipment that will do better work and do it more economically, with less chance of a breakdown. To obtain reliable data many of the manufacturers maintain research laboratories directed by scientists of the highest type. Such a laboratory is maintained at East Pittsburgh by the Westinghouse Electric & Manufacturing Company and is directed by C. E. Skinner, to whose researches is due no inconsiderable part of the advance in electric machine design.

The most important of Mr. Skinner's contributions to science and to the industry is undoubtedly his work on insulation. Insulation was his first assignment, and probably every month that has since passed has brought to him a new problem.

The determination of the most suitable kind of steel for core use is another of his well-known accomplishments. To him is credited the discovery that steel with a silicon content of 4 to 5 per cent is low in hysteresis losses and does not age.

Special attention has also been given by Mr. Skinner to the subject of copper alloys for structural, current-carrying, resistance and bearing purposes, and he has discovered at least thirty-two new alloys. Many other subjects have engaged his attention and that of his staff, including electrical hazards, waveforms and apparatus design.

Mr. Skinner was born near Redfield, Ohio, on May 30, 1865, and was graduated with the class of 1890 from Ohio State University. In that year he joined the Westinghouse organization in the controller department and supervised the construction of the first controller turned out by this company. Soon afterward he was placed in charge of the testing of insulation, and in 1892 he was transferred to the research laboratory. In 1895 he was placed in charge of insulation design in the engineering department, taking charge in 1902 of the insulation division of this department, together with the chemical and physical laboratories. Four years later he organized the research division, of which he has remained in charge.

Mr. Skinner has contributed frequently to the literature of the industry and is well known for his researches abroad as well as in this country. In 1915 he was the special representative of the American Institute of Electrical Engineers, of which he is a fellow, at the international conference on electrical standards held in London, and he is now a member of the committee representing the Institute on the International Electrotechnical Commission. He was chairman of the American delegates to the Brussels meeting in 1920. He is, besides, a member of the Franklin Institute, the American Physical Society and the American Society for Testing Materials. Mr. Skinner was a member of the National Research Council in 1917 and 1918 and also a member of the advisory council of the division of engineering.

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Larger Sales of Junior Securities Necessary

LAST week there was offered to the public about twenty-three millions of electric public utility securities in the shape of bonds and gold notes paying a return of from 7.15 to 8 per cent. These issues were intended for the most part to retire loans or to provide additional working capital, and the rapidity with which they were sold indicates a better appreciation on the part of investors of the value of electric public utility securities. But, excellent as the showing is, it must not be overlooked that with every bond the necessary equity should be provided through junior financing. Generally capital requirements should represent about from 60 to 70 per cent bonds and from 30 to 40 per cent stocks. It is one thing to dispose of bonds, and the general public may gain the impression that because bonds are quickly salable the financing needs of the utility are being met. But stocks as well as bonds need to be sold, and since it is about ten times as difficult to sell stocks, every effort to dispose of such junior securities through the sale of preferred or common stock to customers or to employees and others should be followed energetically and persistently if a sound financial structure is to be assured.

What Does the Customer Think?

PSYCHOLOGY is a much-worked if not an overworked word, but nevertheless the thing it denotes plays a tremendous, yet too little understood, part in utility dealings with the public. At a recent convention an operator told of the resentment of a customer against his company because of the use of the initials of a clerk in countersigning a customer's deposit receipt. The initials formed a common and vulgar street expression that increased the customer's irritation over the deposit rule. The occurrence resulted in an order that all papers intended for the public and requiring an employee's signature must be signed with the employee's full name.

Some time ago one prominent electric utility executive in discussing proposed rate schedules with members of his official staff objected to the word "demand," because, he said, "People resent anything that hints of demands on them." Ever since this objection was made none of the newly drawn rate schedules of one of the largest utility property groups in the United States have carried this word, though the demand form of rate continues to be extensively used.

Such incidents, while they may at first glance seem ridiculous, are merely further indications that customers are human beings and, as such, are very "uncertain quantities." Ability to foresee the effect on the public of the little things in company practice is a vital factor in the make-up of a successful utility operator. Many men of long experience would be astounded at some of their customers' viewpoints. It is well for executive officers to study these viewpoints carefully and as far as possible put themselves in the customer's position.

Lower Prices Contingent on Lower Labor Costs

THERE are a lot of people who refrain from buying on the theory that prices are still too high. Deflation, they say, must run its course, and to that all agree. But how are we to enjoy pre-war prices with transportation, labor and taxes at their present high level? Having mortgaged the country to carry on the war, we must meet our war obligations of more than four billions a year for at least five years, which means that the tax burdens will remain about as they are, although distributed differently. Transportation, however, is double the pre-war cost, owing chiefly to the high price of labor, and labor because of living costs which are still 61.6 per cent above 1914 insists on its increased wage. The effect of these causes is well illustrated in the case of such a basic commodity as steel. The present base rate on bars at Pittsburgh is $35 a ton. Freight on the raw materials necessary to make the ton of steel is $20. Although handicapped with freight double the pre-war rate and increased fuel costs, steel, so far as the manufacturer is concerned, is below the ten-year average before the war. Copper, also, as every one knows, is less than it was ten years before the war, so that the highest cost of manufactured electrical goods made up chiefly of steel and copper represents labor and transportation, which is largely labor. Therefore there is no escaping the conclusion that if prices are to come down labor costs must come down or labor must produce more to offset the handicap.

Will the Coal Industry Clean House?

IN CONSIDERING the coal problem it is well to remember that that industry is suffering from the extended spree of the post-armistice period in just the same way as every other line of business activity. The speculative fever of a year ago was only the culmination. It is probably true that the business as a whole is not making money at the present time. The cries about losses now being taken are no more than can be heard from many another industry and are produced by the same fundamental causes. The industry, along with the rest of the country, is simply paying the price that was to be expected, and the answer to its problem is the same answer that every

other industry must find. In effect it is a thorough housecleaning. In this housecleaning must be included not only the reduction of miners' wages and of freight rates but a reduction of margins all along the line to a point where a profit can be made on the production that ought to exist to supply the needs of a prosperous and busy country, and not on the production that obtains at present because the consumer cannot or will not pay the prices necessary to give a profit on a low production basis.

The coal industry is one of the vital industries of the nation. It must clean house and get down to a sane business basis. Will that cleaning come from internal or from external sources? If the cleaning must come from an external source, not only will the producers suffer, but the miner, the sales forces and every factor in the industry. There must be an end to the internal "passing of the buck" that is now being indulged in. Transportation costs, cost of power to operate all industry and the cost of living are affected vitally. Some one will find the solution. Who shall it be?

Team Play Between Industrial Engineers and Accountants

IN THE course of the rapid advance of the industrial electrical engineer from the status of a wiring supervisor and all-around repair foreman many loose ends in organizing effort have been left to dangle hither and yon. Many industrial plants are improving their organizations in these days of looking equipment and methods squarely in the face, and this is an excellent time for strengthening interdepartmental relations all along the line from the "front office" to the storehouse. Much good might be effected in some plants by taking advantage of the present opportunity for establishing better inventory methods, operating and maintenance cost records, for rerouting reports of service performance, and for scrutinizing charts and tabular data pouring into executive quarters from remote instrumental locations and concentrated centers of electrical supply and distribution. Here the industrial electrical engineer and the accountant can "get together" for their mutual benefit and for the good of the company.

The whole scheme of accounts classification, so far as it relates to the operation of the electrical sections of a plant, always should be understood clearly by the men responsible for electrical operations. There is a danger that insularity in relations will obscure this understanding if things go on year after year with little or no personal contact between the plant electrical engineer and the accounting executive. Changes in equipment often lead to the discarding of accounting forms—or should do so—in order to make way for something better. Subordinates may be tempted now and then to include certain expense items under incorrect classifications, and so wrong conclusions may be drawn at headquarters about the performance of equipment, with a resulting train of untoward possibilities. It is open to consideration whether some accounting classifications are not too "wooden" to yield any really useful technical information, while others which are very valuable suffer from the absence of joint consideration by representatives of the engineering and accounting branches of an establishment. No new classification should be put into effect without giving the industrial plant engineer some opportunity to study the proposed layout and to discuss it with his colleagues of the accounting department. Each branch can learn much from the other, and where team play of the right kind exists real progress is virtually guaranteed. But open-minded willingness to learn as well as to suggest is the price here as in many other places.

Customer Ownership of Securities A Help in Rural Service

THE businesslike way in which the San Joaquin Light & Power Corporation is attacking the problem of serving rural consumers in central California is very well described by E. P. Smith in this issue. A controlling committee has been organized which has charge of all of the important phases of the work. Only by such means could the work be completed within the time allowed. As the financing of rural extensions is an absorbing topic at this time, the San Joaquin Light & Power Corporation is indeed fortunate in having laid a foundation of customer ownership which has facilitated its financing. The consumers and prospective consumers in the territory served by that company have become convinced of the fact that electric service, particularly for pumping water for irrigation, is a prime necessity, and they have ardently supported the company in its efforts to dispose of its securities in its own territory. Readers of the ELECTRICAL WORLD will recall the articles by A. E. Wishon, general manager of that company, who fathered the self-interest appeal based upon statistics derived from the San Joaquin Valley. These statistics showed not only that the growth of the rural districts was dependent upon electrical energy, but also that the industries and the cities were equally dependent upon it as a consequence of its utilization in the suburban districts.

Make Rate Schedules Less Technical

"WE HAVE been doing the finest job of technical work that the world ever saw, but as merchants we in the central-station industry have been about the worst," was a remark that started a lively discussion during a talk on the subject of rates for the sale of electrical energy. The remark was made by a man whose duties at the present time are all concerned with rate problems, but he spoke from an experience that extends far back into the early days of the industry and has dealt with both its technical and commercial phases. He pointed out that rate schedules have usually been so technical in character as to prevent the ordinary individual from getting a mental grasp of their meaning. The practical result has been the education of consumers to a belief that an understanding of the product they purchase is beyond their mental capacity. That this has played an important part in the feeling of distrust that has been so large a problem in the electric light and power field is the settled belief of the official we have quoted.

There is considerably more than a grain of truth in the statement. All electrical men are more or less familiar with rate schedules that even the rate expert must reduce to the form of a curve in order to see what they mean. In the effort to solve technical problems sight has been lost of the fact that the product to be sold must go to people who are not interested in

the technical aspects presented. Sight has also been lost of the fact that the unit of measurement employed is not the thing that is being sold any more than the dry-goods dealer sells the yard in selling his wares. He is selling the goods, or in reality the service they are capable of giving. The yard is only a convenient unit of measurement. The central-station company is selling service, and the kilowatt-hour is only the measure of that service. Unfortunately attention has been concentrated on the unit of measurement until the customer has lost sight of the real thing that he is paying for. In place of concentrating his efforts on the understanding of the nature of the service he has been vainly trying to obtain a mental grasp of the technicalities of the unit of measurement. The consumer should be no more concerned with the technical foundation of that unit than he is with the technical foundation of the units of anything that he purchases. He never thinks of the physical meaning of the other units of measure that he comes into contact with because he has never been educated to think of them in any other way than as measures of something he pays for.

The difficulty lies in the predominance of the technical side of central-station business during its development period. We are now at the point where the technical side of the work may be said to have reached a condition of stability. This does not mean that further technical progress will be slow and more or less at an end, but only that ways of accomplishing results have developed so that there are well-tried methods available for accomplishing any desired ends. These will be depended on until further experience develops better methods, and the industry will not be lost in the meantime. In the future it will be necessary to view the industry so far as the public is interested from a merchandising point of view. It has ceased to be a novelty and has become a necessity. Its technicalities must be buried within itself as are the technicalities in every other well-developed industry. This means the better development of merchandising methods. One of the important problems is developing rate schedules that can be understood by the customer and that will teach him to think of the thing that he is really paying for.

More Industrial Plants Should Study Maximum Demands

IN ALMOST all manufacturing processes the value of electric power has been demonstrated, yet it is a fact that a great many manufacturing installations are far from being as efficient as they should be. This condition is shown up in the load factors as the central station finds them, and in the maximum demands on which the payments for power generally turn. A brief paper by R. S. Lowry cites some telling instances of wasted power having its origin in clear inattention to the operating detail in a plant. One such, for example, is a thoroughly modern steel mill in which it was found that the maximum demand for the month, which counted heavily in the bills, had its origin in high calls for power on every Monday morning. This information was disclosed by inspection of the graphic meters, which tell an invaluable tale in manufacturing operations. It turned out that insufficient time was allowed for warming up the roll trains to their work, which resulted in an excessive demand that showed unpleasantly when the meters were read for the month. A little further investigation disclosed that the demand could be considerably reduced by careful alignment of the roll train and close attention to the bearings. The latter cause came in with especially unpleasant effect in the cold-rolling operations, here traced to abnormal friction which could be obviated. And so the story went. A thorough investigation of the power consumption in the plant indicated changes which when made showed a reduction in power costs at the rate of $24,000 per annum.

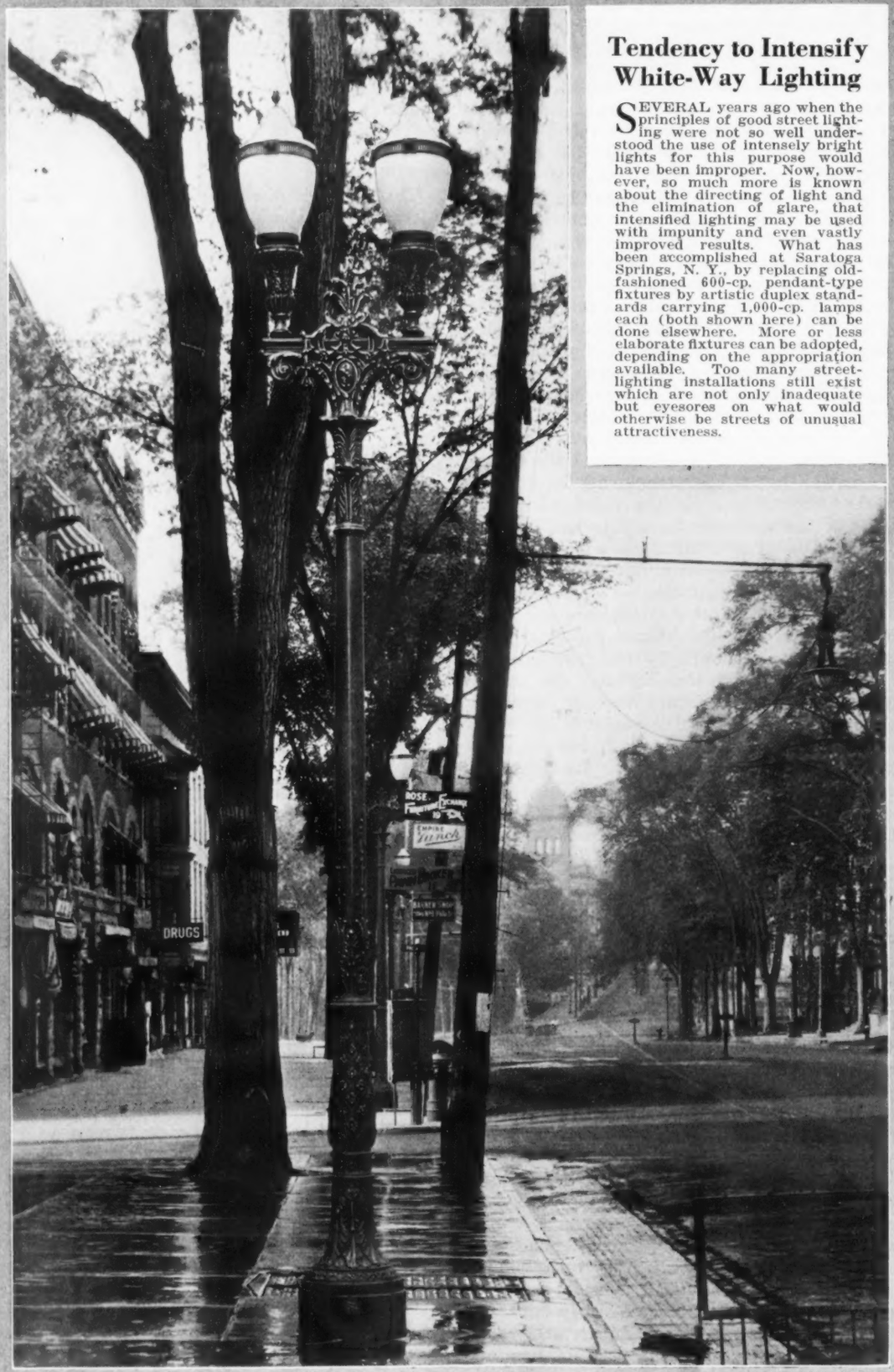
This figure is more than sufficient to cover the costs of far more elaborate investigation than was required and suggests that time and money spent in plugging financial leaks like this are well invested. Cases such as Mr. Lowry describes are far more common than the average manufacturer realizes.

A New Opportunity—the Central Station to Flash the Correct Time

SOMETIMES we have to go a long way off to find a simple thought that should have come to us at home. Such is the new idea of a service of correct time from the electric light company that has been universally established in the Republic of Uruguay. Every evening there at 8 o'clock in every community served by a central station the lights are "dipped" and go dim for an instant, thereby flashing the correct time. In the homes, in stores, restaurants, offices, public buildings or on the streets the message reaches all the people. Throughout that country the clocks and watches are habitually regulated to this time flash and the service is greatly appreciated.

Here is an idea for American central-station companies—an opportunity to inaugurate a new service free to the entire community that will unquestionably win hearty popular approval. The experience of the telephone companies is proof that the service will be appreciated, for the requests from telephone subscribers to be told the time placed so heavy a burden on telephone operators that during the war they had to be prohibited as a measure of conservation. The fact that the announcement by electricity of the evening hour has been standardized in the South American republic and is, for that matter, already instituted as a service innovation in Schenectady is evidence that it is practicable from an operating standpoint. It cannot be an expensive service, but, cost what it may, the fact that it will be the most conspicuous evidence of thoughtfulness that the electric light and power company has ever been able to express will make it of no small value from the public policy point of view, and the importance of that point of view is more widely recognized at this time than it has ever been before.

A service of correct time flashed to all the people —consumer and non-consumer alike—would literally make every citizen think once every day of the electric light company and think favorably. It would be a daily reminder of the dependence which all place upon the modern utility. It would be an impressive little act of courtesy that all men would notice and commend. The central-station company has never had within its reach a simpler, more appealing means of expressing the spirit of its service, and its cost will be negligible. Correct time signals should be made a feature of electric lighting service throughout the land.



Tendency to Intensify White-Way Lighting

SEVERAL years ago when the principles of good street lighting were not so well understood the use of intensely bright lights for this purpose would have been improper. Now, however, so much more is known about the directing of light and the elimination of glare, that intensified lighting may be used with impunity and even vastly improved results. What has been accomplished at Saratoga Springs, N. Y., by replacing old-fashioned 600-cp. pendant-type fixtures by artistic duplex standards carrying 1,000-cp. lamps each (both shown here) can be done elsewhere. More or less elaborate fixtures can be adopted, depending on the appropriation available. Too many street-lighting installations still exist which are not only inadequate but eyesores on what would otherwise be streets of unusual attractiveness.

Reducing Manufacturing Costs by Studying Power Demand

Systematic Study of This and Energy Consumption Will Often Disclose Inefficient Operating Conditions and Causes of Unnecessary Expenditures—Methods of Handling Some Specific Problems Outlined

By R. S. LOWRY*

THE principal reason that manufacturers in the United States have been able to compete with those in Europe, where labor is so cheap, is because machinery has been used to a greater extent in this country as a substitute for labor. Even though the cost of power to run that machinery is a small percentage of the cost of producing the manufactured article it must be kept at its lowest figure to help meet the keener growing competition. Until the small, inefficient generating stations are supplanted by a few great central stations, however, energy cannot be obtained much cheaper than it is at the present time. Therefore the strictest economy must be practiced in the use of power, inasmuch as paying for power wasted is the same as paying for energy at a higher rate.

In an attempt to reduce labor costs some concerns employ unskilled men as electricians, their duties being merely to keep the electrical equipment running in some manner or other, and no questions are asked as to how efficiently. However, money saved in labor costs and paid out in power bills never adds to the earnings of the manufacturing company, although it does allow a different distribution of operating costs. In any industry where a systematic study of the monthly power demand and consumption and their relation to production has not been made the results of an intelligent investigation will be found startling.

Intelligent Supervision Worth Its Cost

Sometimes serious faults may exist in the original installations or faults may develop later which cause unnecessary power cost. An example of this kind occurred in a roofing-tile works near Chicago. In the company's two years of operation with electric drive there had been continual shutdowns on account of overloaded generators and various troubles in the electrical equipment, and the power cost was excessive. An investigation disclosed that a second-hand 100-kw. compound-wound generator had been installed as a motor on a clay-crushing machine without changing any connections on the generator. Obviously the differentially connected motor speeded up excessively when the load occurred and the increased speed of the crushing machine caused it to "pull" very heavily on the power. On the same line with the crushing machine motor a 100-hp. mixing-machine motor had been connected. When the crushing machine motor pulled so heavily that it blew its fuses the mixing-machine motor also blew its fuses due to the surge in the voltage. At times the main circuit breaker went out and completely stopped operations. By simply cutting out the series field of the differentially connected motor and using it as a shunt motor the worst troubles were ended and the load on the power plant never went above its capacity.

Efficient working of the machinery in operation and not larger generating equipment was needed in this plant. Power was being wasted. The foregoing is an exceptional case where the largest power saving was brought about by improvement in the installation.

No Plant Should Be Without Graphic Meters

Sometimes the original equipment may be faultless and yet there may be great opportunities to create power saving by a study of operating conditions, a rearrangement of loads, etc. Studies of this kind should start with an examination of the demand charts. If the customer has a few exceptionally high peaks he will have to pay for his share† of the annual cost of equipment necessary to furnish that service for only a few minutes' use of the service. So far as his maximum demand bill for the month is concerned he might just as well have used the maximum steadily throughout the month as the demand billing would have been the same, although the consumption charge would be higher. In other words, the maximum-demand charge is the rent the consumer must pay the electric service company for use of equipment of a certain capacity determined by the demand meter. He can use that equipment for the full month for no extra charge, except the consumption charge, once the maximum demand has been determined by a few minutes' use.

Evidently it is to the service user's interest not to demand a higher capacity than he can use steadily throughout the month. The desired end may be arrived at in a number of ways, depending on conditions. Sometimes certain operations can be performed at night if the day load is heavy. Where a number of large machines are to be started they might be thrown on the line at various times instead of all at one time. Numerous ways will suggest themselves to one familiar with conditions. The first important step in reducing power bills is lowering the demand to the minimum figure. This may be determined in a few minutes, depending on the period of the demand meter and the number of high points required by the service company in averaging the billing demand.

How Records Showed a Power Waste

An interesting example of the possibilities of reducing manufacturing costs by way of the power bill is afforded by a steel mill in the Mahoning Valley making high-grade sheets for automobiles. This mill has the most up-to-date machinery and is entirely electrically driven. After this steel works had been in opera-

*Formerly electrical engineer Newton Steel Company.

†Purpose of maximum-demand charge.

tion to its capacity for one month an examination of the demand chart of the total mill load disclosed the following condition: The highest peaks usually came at about 2 a.m. each Monday, the curve dropping off slightly toward 7 a.m., and then suddenly rising at that hour to about where it had been at 2 a.m. A slight sloping off in the curve after 7 a.m. then began and continued the rest of the day, when the curve with the exception of a few occasional peaks became fairly straight the rest of the week. It was apparent that four or five days in the month, or, worse yet, about fifteen minutes out of each of these days, were regularly determining the month's demand bill.

Sheet-steel mills shut down the hot mills for changing rolls and repairs on Saturday morning and start operations again at midnight Sunday. Of course the roll train and driving equipment cools off in that time and necessarily pulls hard when started. In this particular mill one hour had been allowed for "warming up," it being assumed that in that time any troubles in the roll train would show up before the first turn came on. However, an inspection of the demand curve of the drive motor showed a steady rise from the time the first turn started until a maximum peak was reached at about 2 a.m., when all mills were working at capacity. This work load, piled on top of the heavy friction load of the roll train, accounted for the peak around 2 a.m. As the mills warmed up the curve dropped off somewhat. At 7 o'clock the cold rolls mills came on, and being started after the shutdown over Sunday, when the mills cooled off, they added their friction load and work load to that of the hot mills motor.

The demand curve of the drive motor of the hot mills showed that it took four to six hours for the friction of the roll train to reach constant value. Starting the drive that much earlier would have hastened this condition, but it would not pay, as the consumption of the motor would increase and tend to counteract the reduction in the demand. Three hours for warming-up was found sufficient to flatten the curve. Likewise by allowing the cold-roll mills a warming-up period of one hour the peak of their demand curve, which had been occurring at 7 o'clock, was flattened.

DEMAND CURVE SHOWS VARIOUS TROUBLES

Careful alignment of the roll train at each setting-up time is a big factor in reducing the demand and consumption of the drive motors. The demand curve quickly shows up poor alignment once the minimum necessary idle demand is known. In changing mills each week for years there is liable to be some carelessness in setting up and this is paid for in power bills. The condition of bearings also affects the pull greatly. Brasses that cut and wear badly, scarcely lasting the week out, must be replaced by a better quality. In this plant it was found possible to get brasses that stood up for several weeks without cutting or wearing seriously. Worn and broken brasses cause a low mill and spoil the alignment; low housings or sunken bedplates cause the same trouble. These troubles all show up seriously in the power bills.

Next to the hot-mill motor the cold-roll motors were the largest users of power in the plant under consideration. As the mills are generally allowed to run several weeks without changing rolls worn bearings may develop and spoil the alignment, running the power demand considerably above normal. When some quality of sheets are being cold rolled it is the practice of the cold-roll foreman to use running water on the roll necks to cause an uneven expansion of the rolls and give the desired contour. By cooling the necks below a good running heat, however, the water greatly increases the friction and causes the demand curve to mount rapidly. For such periods the high points for the billing demand are often determined as double the normal power requirement. Since heating the rolls by electricity is very expensive, the desired result may be obtained by using a kerosene blow torch applied to the middle of the bottom roll. If natural gas is available a gas burner would be better. Eliminating the water and using applied heat to obtain the unequal expansion reduces the power demand to normal.

The powdered coal plant, being the next heavy user of power, came in for its share of investigation. As near as possible all grinding was done at night when the cold rolls were not running. No two pulverizing mills were started at the same time so their demands were not additive. Sufficient coal was ground on Sundays so that no grinding would have to be done when the shift came on at midnight and the mills were warming up. Being a scattered load, the remaining motors in the mill had less effect, but by eliminating unnecessary friction and operation considerable reduction was effected in the energy consumption.

After one month's running under the improved conditions and with an equivalent production the total power bill for the month showed a reduction of 12 per cent compared with the previous month, or approximately $24,000 for the year.

Any attempt by an engineer at reducing power bills is made easier by first enlisting the co-operation of the foremen of each department of the mill or factory. The demand charts of their respective departments should be explained to them and the causes of the various peaks discussed. The foremen should be encouraged to watch the chart through the day and to develop the habit of using the demand meter as a clock for telling the time of day, as it is very accurate and draws their attention to the chart. As the foremen are familiar with the product of their departments they know whether there is any variation in the quality of the output that would cause any wide variation in the demand on the power or whether some undesirable condition is present that could be eliminated. For instance, annealed sheet steel pulls harder on the motor in cold rolling than in hard sheets, and finishing long sheets in the hot mills uses up the stored energy of the flywheels and draws heavily on the power. At these times a peak in the demand chart would be expected. By a careful study of the demand charts each month it is possible to tell just which department is wasting power and therefore is responsible for determining the demand bill for the month. Usually when the fact is brought to the attention of the foremen a few times they will make a special effort to save power.

Where an industrial plant generates its own power there is a tendency to be wasteful in its use because a settlement does not have to be made each month for use of a definite number of kilowatt-hours and kilowatts of demand. However, if efficiency studies start with the building of the mill or factory, a smaller generating plant will be needed and the extra investment in large reserve capacity to take care of a few unnecessary peaks, like the "warming up" peaks of a steel mill, will be eliminated.

Connecting 44,000 Hp. of Rural Load

Careful Planning Is Found Necessary to Handle Four Thousand Service Connections in the Order in Which Application Was Made

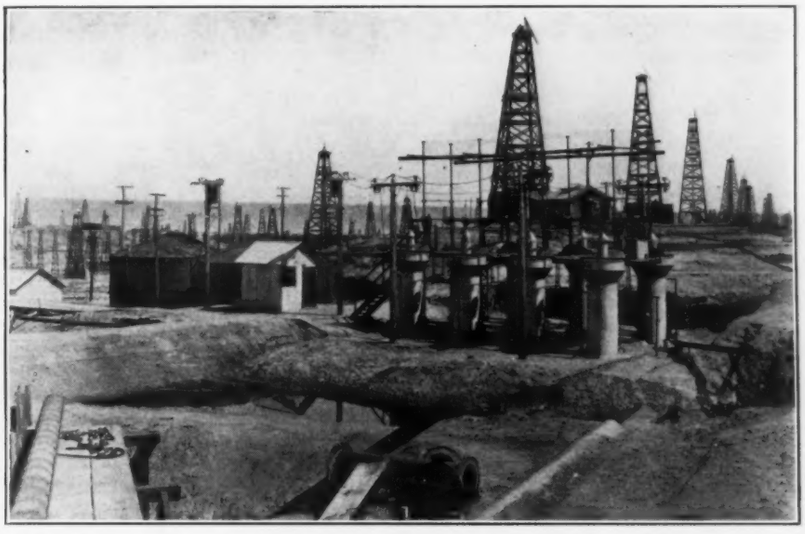
BY E. P. SMITH
San Joaquin Light & Power Corporation

AT THE time the armistice was signed the San Joaquin Light & Power Corporation found itself, like other companies of California, with an accumulation of three years' unfilled business following a period of unusual activity during which no generating stations were constructed. The situation was made more acute by a failure of the normal snowfall and rainfall, which greatly reduced hydro-electric power and made it necessary to operate obsolete steam plants to take care of the heavy load. After additional generating facilities had been provided and the power crisis had passed attention was directed to a waiting list of 3,688 prospective consumers. This list had grown from one of about 200 at the close of the war.

To handle this work an organization known as the priority committee was formed, consisting of a representative from the general manager's office, the purchasing agent, the manager of the commercial department, the general storekeeper, a clerk from the construction department and a secretary for the committee work. The duties of this committee were to look after all work pertaining to new line construction and consumer connections. The priority list, a duplicate of which was in the hands of the California Railroad Commission, was used as a guide in making connections. All applications for extensions had to pass through the regular routine of the estimating department, and the cost of making extensions was properly apportioned. These estimates, or jobs, were then listed in order ready for action by the committee. Materials were ordered, freight shipments were traced, truck equipment was provided, and materials were distributed to various districts where needed. Help was also obtained for the construction work.

Where an application was made for rural service the following ruling was observed:

All agricultural service will be normally rendered when the annual revenue to be derived equals or exceeds 33⅓ per cent of the cost of the extension. If such annual revenue is less than 33⅓ per cent but more than 20 per cent of the cost of the extension, the applicant may obtain service by first advancing the entire cost of the extension, such ad-



PUMPING MAKES UP A CONSIDERABLE PART OF THE RURAL LOAD IN CALIFORNIA

On the left is shown a typical farm irrigation pumping plant. The average installation requires a 10-hp. motor which pumps water for a 40-acre farm. About 2,500 plants of this type will be installed this summer in the San Joaquin Valley alone. On the right is shown an oil field with a bank of dehydrators in foreground. The demand for power in the oil fields is growing.

TABLE I—SUMMARY OF THE APPLICATIONS, CLASS OF SERVICE AND CONNECTED LOAD

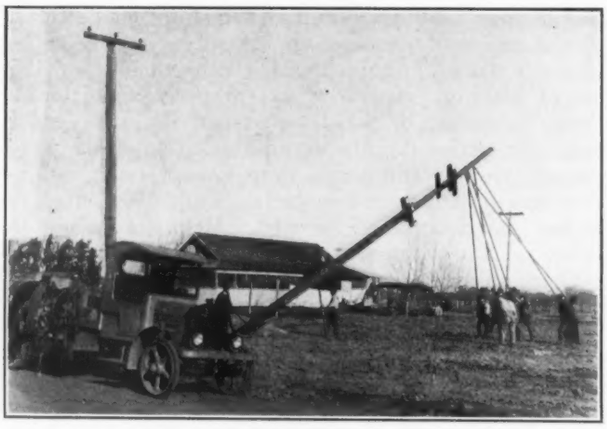
(Nov. 1, 1920 to Jan. 15, 1921)

Class of Service	Applications	Horsepower
Irrigation	2,471	35,907
Industrial	180	3,898
Oil well	28	2,085
Domestic	590	1,069
Lighting	1,233	1,644
Total	4,502	44,603

TABLE II—TRANSFORMERS REQUIRED TO HANDLE THE RURAL LOAD IN TABLE I

The following complete list of transformers purchased indicates the relative segregation that may be found in rural service. The 3-kw. size predominates both in actual numbers and total capacity—the 5-kw. size being second in total capacity. The combined total capacity of all the transformers is 42,955 kw., or 112.9 per cent of the applied-for kilowatts.

No.	Rating, Kw.	Voltage — Primary	Voltage — Secondary		Total Capacity, Kw.
1,615	1½	6,600	110	200	2,425
2,470	3	6,600	110	200	7,410
1,159	5	6,600	110	200	5,800
394	7½	6,600	110	200	2,955
72	10	6,600	110	200	720
164	10	6,600	220	440	1,640
136	15	6,600	220	440	2,200
41	15	6,600	110	220	615
1	20	6,600	220	440	20
145	25	6,600	220	440	2,900
12	25	6,600	110	220	300
1,340	2½	11,000	110	220	3,350
482	5	11,000	110	220	2,410
54	10	11,000	110	220	540
12	10	11,000	220	440	120
6	15	11,000	220	440	90
12	15	11,000	110	220	180
9	20	11,000	110	220	180
5	25	11,000	110	220	125
6	25	11,000	220	440	150
92	37½	11,000	220	440	3,450
28	50	11,000	220	440	1,400
7	50	11,000	110	220	350
12	75	11,000	220	440	900
15	75	11,000	460	2,300	1,125
4	100	11,000	220	440	400
3	150	11,000	220	440	450
3	150	11,000	460	2,300	450
3	100	11,000	460	2,300	300
8,302					42,955



THIRTY-NINE LINE CREWS SIMILAR TO THIS WORKED ON EXTENSIONS REQUIRED IMMEDIATELY AFTER ARMISTICE

vancement to be refunded on the basis of 20 per cent of the monthly bills.

If the applicant constructed at his own expense a part of the line sufficient to make the annual revenue equal 33⅓ per cent of the cost of that part of the extension which was made at the company's expense, the application was also granted. On account of franchise rights and similar considerations, the company in this case built the entire extension and the consumer advanced the difference between the three-year revenue and the cost of the extension.

The applicant could also insure the building of the extension by guaranteeing business of a kind acceptable to the company sufficient to equal 33⅓ per cent of the cost of the extension. When the annual revenue to be derived was less than 20 per cent of the cost of extension, the company was not normally required to render service.

In a few cases of long extensions requiring transmission lines and substation installations the applicant was requested to aid in financing the extensions by the purchase of stock to cover part or all of the cost. However, an endeavor was made to adhere strictly to the 33⅓ per cent rule, and in no case was service made contingent on the purchase of stock.

The handling and distribution of the vast stores of materials necessary was a big problem in itself. A fleet of thirty-nine trucks was used to handle the line work. Each truck carried a crew of eleven men, consisting of a foreman, four linemen, five groundmen and a truck driver. The total of the thirty-nine crews required approximately 430 men in the field to construct distribution lines. The line crews built the lines, handled the transformers and strung the service wires, while other crews set the meters and made the connections. Under normal conditions a crew setting meters and making service connections can connect only about six a day.

A TOTAL OF 577 CARLOADS OF MATERIAL WERE REQUIRED FOR RURAL WORK DURING WINTER OF 1920-1921

Three thousand poles awaiting treatment and distribution. Some of the material which was required for the work follows: 20,000 poles, 2,000,000 lb. wire, 150,000 insulators, 900,000 ft. cross-arm material, 2,600 single-phase meters, 1,400 polyphase meters and 8,302 transformers.

Choice of Electric Furnace Refractories

NEARLY all the interior refractories used in electric furnaces fail to meet the requirements of present furnace practice. It is therefore important to analyze the different furnace requirements if the best use is to be made of the available refractories.

Some of the special requirements of refractories for the electric furnace are contained in the following summary:

1. *Melting Point.*—Must be at least as high as that of silica (1,700 deg. to 1,750 deg. C.) and preferably much higher.

2. *Resistance to Sudden Temperature Changes.*—This is important, since a furnace must often turn out a heat in two hours, starting cold. This requirement is much more severe than with the slower-melting, fuel-fired furnaces.

3. *Constancy of Volume.*—Refractories which have been fired only at the temperatures attainable in fuel-fired furnaces may undergo marked volume changes when used in the higher-temperature electric furnaces. The ideal refractory for electric furnace use should therefore be calcined in an electric furnace during manufacture.

4. *Resistance to Slags.*—In steel-melting practice an oxidizing and a reducing slag are used in conjunction with a very high temperature—the severest possible service for the refractories on the slag line. If an induction furnace is used, the slag corrosion may be increased by erosion problems because of circulation of the metal bath. The same is true to some extent of rocking or rotating arc furnaces.

5. *Resistance to Corrosion by Fumes.*—The point of attack is the roof. The fume corrosion may be increased by particles of molten slag thrown up from the hearth. The extremely high temperature of the roof accelerates the corroding effect. Furthermore, the roof is subjected to many mechanical strains due to the water-cooled parts being adjacent to parts subjected to extremely high temperatures.

6. *Mechanical Properties at Very High Temperatures.*—If a circulating metal bath is used, as in induction furnaces and in some forms of arc furnaces, the refractory has to possess high resistance to abrasion at elevated temperatures.

In order to meet, or attempt to meet, these requirements, several classes of refractories have been tried out for the different parts of the furnace.

Present practice is to use a good grade of firebrick for the outer walls; this is sometimes laid next to silocel, asbestos or a similar efficient heat insulator. Magnesite bricks are usually laid against the firebrick for forming the inner side walls of the furnace and one or two courses are laid over the bottom layer of firebrick. The rammed-in or built-up hearth of dead-burned magnesite, dolomite, "syndolag" or similar material is then built in. The roof is most frequently made of silica brick, although carborundum and electrically fused magnesite have also been used. The research laboratory of the Foote Mineral Company, Philadelphia, gave out this information at a meeting of the Electric Furnace Association at Columbus, Ohio.

What Constitutes a Reasonable Return

The Point at Which Confiscation Begins Marks the Border Line in Valuation and Rate Fixing for Public Utilities—Exhaustive Citation of Legal Decisions Bearing on This Aspect of Successful Utility Operation

By W. H. BOHLING
Jefferson City, Mo.

THE border line of return to public utilities is briefly discussed in this article under the headings which immediately follow. This discussion is supported by the long list of citations of decisions handed down by federal and high state courts, the numerals preceding each separate group of citations corresponding to the numerals in parentheses that are scattered through the article proper.—EDITOR.

I. Introductory, § 1.
II. In general, § 2.
III. Cost of money, §§ 3-5.
A. Interest rate on utility securities, § 3.
B. Legal rate of interest, § 4.
C. Prevailing rate of interest, § 5.
IV. Prevailing return on comparable enterprises, § 6.
V. Fluctuations, § 7.

§ 1. *I. Introductory.*—Constitutional terms providing against the deprivation of property without due process of law (1), the denial of the equal protection of the law (2) and the taking of private property for public use without just compensation (3) safeguard private property devoted to the service of the public in utility enterprises (4). From the monetary standpoint, the constitutional protections afforded have been measured, by the adjudicated cases, in terms per centum on the

1. U. S. Const. Amend. Art. 5 ("No person shall be . . . nor deprived of . . . property without due process of law."); U. S. Const. Amend. Art. 14 ("No state shall make or enforce any law . . . nor shall any state deprive any person of . . . property without due process of law"). See state constitutions.

2. U. S. Const. Amend. Art. 14 ("No state shall make or enforce any law . . . nor deny to any person within its jurisdiction the equal protection of the laws.")

3. U. S. Const. Amend. Art. 5 ("No person shall be . . . nor shall private property be taken for public use without just compensation."). See state constitutions.

4. Smythe v. Ames, 169 U. S. 466, 18 Sup. Ct. 418, 42 L. ed, 819; Reagan v. Farmers L. & T. Co., 154 U. S. 362, 38 L. ed. 1014, 14 Sup. Ct. 1047; Cotting v. Kansas City Stockyards Co., 183 U. S. 79, 22 Sup. Ct. 30, 46 L. ed. 92; Pioneer T. & T. Co. v. Westenhaver, 29 Okla. 429, 118 Pac. 354, 38 L. R. A. (N. S.) 1209; Spring Valley Wks. Co. v. San Francisco, 165 Fed. 667; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Chicago, M. & St. P. Ry. Co. v. Minnesota, 134 U. S. 418, 33 L. ed 970, 10 Sup. Ct. 462, to enumerate a few only.

5. Smythe v. Ames, 169 U. S. 466, 18 Sup. Ct. 418, 42 L. ed. 819; Covington, etc. T. R. Co. v. Sandford, 164 U. S. 578, 17 Sup. Ct. 198, 41 L. ed. 560; Reagan v. Farmers L. & T. Co., 154 U. S. 362, 14 Sup. Ct. 1047; 38 L. ed. 1014; Brass v. North Dakota, 153 U. S. 391, 14 Sup. Ct. 857, 38 L. ed. 757; Stone v. Farmers' L. & T. Co., 116 U. S. 307, 6 Sup. Ct. 334, 338, 1191, 29 L. ed. 636, to enumerate a few only.

6. Northern Pac. Ry. Co. v. Lee, 199 Fed. 621.

7. Home Tel. Co. v. Carthage, 235 Mo. 344, 139 S. W. 547; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613, and see the many cases cited herein.

8. Omaha & C. B. Ry. Co. v. Nebraska Ry. Comm., 103 Neb. 695; 173 N. W. 690, P. U. R. 1919F, 307, 312; Re Peoples Natural Gas Co., P. U. R. 1916A, 349.

9. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574; Spring Valley Wks. Co. v. San Francisco, 165 Fed. 667 ("To say that a body of rates which affords some compensation, but something less than a reasonable compensation, is not confiscatory, is simply to say that the constitution protects a portion, but not all of a man's property" l.c. 678); Monongahela Nav. Co. v. United States, 148 U.S. 312 13 Sup.Ct. 622, 37 L. ed. 463 ("Before this property can be taken away from its owner, the whole value must be paid." l.c. 329); Virginia & T. Rd. Co. v. Henry, 8 Nev. 165 ("It is difficult to imagine an unjust compensation; but the word 'just' is used evidently to intensify the meaning of the word 'compensation'. To convey the idea that the equivalent to be rendered for property taken shall be real, substantial, full, ample; and no legislature can diminish by one jot the rotund expression of the constitution. So are all the decided cases." l.c. 171); Spring Valley Wks. Co. v. San Francisco, 82 Cal. 286, 22 Pac. 910, 6 L. R. A. 756, 16 Am. St. Rep. 116 ("When the constitution provides for the fixing of rates or compensation, it means *reasonable* rates and *just* compensation. To fix such rates and compensation is the duty and within the jurisdiction of the board. To fix rates not reasonable or compensation not just is a plain violation of duty." 82 Cal. l.c. 306).

Reason.—"As the right to use property for any lawful purpose to the extent of the realization therefrom of a return or reward commensurate with the reasonable and just value of such use is an element of property, property itself *pro tanto*, since without the right of such use, it would be wholly or partially valueless, according to the extent of the restraint upon its use, deprivation of the use thereof, or denial of the power to earn such reasonable and just return or reward by the use thereof, in whole or in part, without compensation therefor, amounts to such wrongful taking thereof, and therefore to confiscation within the meaning of the decisions in cases of this kind. To constitute such confiscation, the taking need not extend to the corpus of the property nor total deprivation of reward for the use thereof. If the law renders it impossible to obtain from the use of the property a reasonable and fair return, it is confiscatory in its operation and effect, though valid on its face. The extent of such deprivation is not the test. Whether a statute is thus confiscatory does not depend upon the amount it takes in violation of the constitution, or the extent to which it interferes with the right of use of property guaranteed by the organic law. It is void if it so takes any at all, or so interferes to any extent whatever. It is condemned, not by the extent of the pecuniary injury wrought, but by its transgression of constitutional limits, its invasion of a constitutional right, as sacred to corporations as to the humblest citizen of the land, and justly so, for the reason, among others, that the property of corporations is in fact the property of citizens, and the law cannot and ought not, in its ultimate results, to favor one citizen or class of citizens over another." Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 188. And see note 12, *infra*.

10. Detroit v. Detroit United Rys. Co., 172 Mich. 136, 137 N. W. 645; Simpson v. Shepard, 230 U. S. 352, 433, 434, 33 Sup. Ct. 729, 57 L. ed. 1511, 1555, 1556, 48 L. R. A. (N. S.) 1151, Ann. Cas. 1916A, 18; Denver v. Denver Union W. Co., 246 U. S. 178, 62 L. ed. 649, 38 Sup. Ct. 278, P. U. R. 1918C, 640; Doherty & Co. v. Toledo Rys. & L. Co., 254 Fed. 597, P. U. R. 1919C, 231.

11. Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Hammond Lumber Co. v. Oregon Pub. Serv. Comm., 96 Ore. 595, 189 Pac. 639, P. U. R. 1920E, 144.

12. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574; Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. 925; Atchison, T. & S. F. Ry. Co. v. Campbell, 61 Kan. 439, 59 Pac. 1051, 48 L. R. A. 251, 78 Am. St. Rep. 328; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; and see Contra Costa W. Co. v. Oakland, 159 Cal. 323, 113 Pac. 668; Stone v. Farmers' L. & T. Co., 116 U. S. 307, 6 Sup. Ct. 334, 338, 1191, 29 L. ed. 636 (dissenting opinions).

Just Compensation.—"What is the meaning of 'just compensation'? . . . The ancient maxim *'De minimis non curat lex'* has no application. "The violation of a constitutional right should never be measured or met by any such plea. It is said that counsel once attempted to argue before Chief Justice Marshall that in the particular instance before the court the invasion of constitutional rights was slight, but he was sternly reminded that the case involved the constitution of the United States and that the degree or extent of the invasion had no bearing upon the point. When a constitutional right is invaded, we are not bound to stand silent so long as moderation is practiced. There can be no greater political blindness, no more dangerous policy than to sanction the infringement of constitutional rights because the particular instance is in itself apparently harmless or seems expedient. Admit the wedge ever so little and there is nothing to prevent its being driven home. We are not compelled to wait until the unconstitutional measure becomes ruinous confiscation or an intolerable interference with personal liberty. In respect to constitutional guaranties we have a right to expect absolute security and protection, and the courts are under a duty to enforce the constitutional provisions guaranteeing our rights wholly irrespective of the degree of infringement. Present inconvenience, however great, present expediency, however tempting, can never justify the slightest disregard of any provision of the constitution." Spring Valley Wks. Co. v. San Francisco, 124 Fed. l.c. 601. (2) "It is clear that the fundamental law, both state and federal, compels the legislature to regulate rates 'in such manner that no injustice shall be done' the property owner. He must have 'just' compensation. Any schedule of rates is forbidden which produces any injustice. The quantum of injustice is immaterial. There must be 'no injustice.'" Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. l.c. 995. (3) "Some writers have spoken of a 'twilight zone of injustice,' in which the legislative body may roam at will in fixing rates, and while acting in this unilluminated region the courts are powerless to control its judgment. That is, as intimated in the majority opinion, that the council may adopt a rate which the court would not, if sitting as a legislative body, regard as reasonable, and yet, sitting as a court, it cannot say is unreasonable. If there is warrant in reason for such a doctrine, the court should at least place some sort of limit to the field in which the rate-making body may exercise an uncontrolled discretion. It is within the proper and rightful

value of the property as evidenced by the income derived from the enterprise above all just charges to operation and depreciation (5). The point where confiscation begins is therefore of importance, and it is with the factors basing most closely upon this border ground for utility endeavors conceived in sound business judgment and efficiently and prudently conducted that the present article is concerned.

§ *2. II. In General.*—What is a reasonable return is a mixed question of law and fact (6), for the ascertainment of which an unvarying rule has not been announced (7), a fair return being as necessary and proper as the wages of a laborer or any other just compensation (8). "Just compensation" as used in the constitution means full compensation (9) notwithstanding the expiration of franchise privileges (10), in the nature of a return from the commencement of the undertaking (11), precluding the approval of a return lower, however infinitesimal, than that which the court can consider as failing to measure up to the constitutional requirements (12).

§ *3. III. Cost of Money: A. Interest Rate on Utility Securities.*—For a prudently conducted utility enterprise the rate of interest it is compelled to pay for borrowed money furnishes a safe criterion of the minimum return to which it is entitled (13); but as the stockholder's lien on the property is subordinate to that of the lender (14), attended with all the risks of

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exercise of its functions for the court to say to the legislative body that any rate which fails to measure up to what the court may declare to be reasonable compensation would be void as unreasonable, and, in my judgment, it is competent for the court, in view of all the circumstances, to say what this minimum should be, having reference to the nature and character of the service to be rendered." Contra Costa W. Co. v. Oakland, 159 Cal. 323, l.c. 358. See, also, note 9, *supra.*

13. Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367; San Diego W. Co. v. San Diego, 118 Cal. 556, 50 Pac. 633, 38 L. R. A. 460, 62 Am. St. Rep. 261 ("An important circumstance will always be the rate of interest at which money can be borrowed for investment in such a business, and, where the business appears to be honestly and prudently conducted, the rate which the company would be compelled to pay for borrowed money will furnish a safe, though not always conclusive, criterion of the rate of profit which will be deemed reasonable. In ordinary cases, where the management is fair and economical, it would be unreasonable to fix the rates so low as to prevent the company from paying interest on borrowed money at the lowest market rate obtainable; and even then some allowance or margin should be made for any risk to which the company may be exposed, over and above the risk taken by the lender." 50 Pac. l.c. 637).

14. Briggs v. Peaks Island Corp. (Me.), P. U. R. 1917E, 750 ("The return on the investment, the cost not exceeding the value of the service, should be sufficient to attract capital to similar investments, with the expectation of getting its reward in dividends from regular earnings—not from the flotation of securities. It must be larger than the rate on money loaned to such corporations, because the lender has a lien upon the property superior to the owner and takes none of the responsibilities of management." l.c. 761).

15. San Diego W. Co. v. San Diego, 118 Cal. 556, 50 Pac. 633, 38 L. R. A. 460, 62 Am. St. Rep. 261; Briggs v. Peaks Island Corp. (Me.), P. U. R. 1917E, 750; Murchie v. St. Croix Gaslight Co. (Me.), P. U. R. 1917B, 384.

16. Murchie v. St. Croix Gaslight Co. (Me.), P. U. R. 1917B, 384.

17. Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367 (holding other action would remove the inducement of investing in such undertakings); Briggs v. Peaks Island Corp. (Me.), P. U. R. 1917E, 750; Murchie v. St. Croix Gaslight Co. (Me.), P. U. R. 1917B, 384 ("If the rate of interest paid by a corporation for money borrowed is 6 per cent, the stockholder ought, under normal conditions, to be permitted to receive a higher return in dividends, if the corporation can earn them." l.c. 394).

18. Re Idaho Power Co. (Idaho), P. U. R. 1920D, 809.

19. Re San Joaquin L. & P. Co. (Cal.), P. U. R. 1920D, 958; Re Mt. Whitney P. & E. Co. (Cal.), P. U. R. 1920D, 938.

20. Re Mount Whitney P. & E. Co. (Cal.), P. U. R. 1920D, 937 ("The cost of money to applicant is in excess of 6 per cent. It has rendered service during the past three years at an average rate of approximately 5 per cent on its reasonable investment, which is a rate of return less than the cost of money it has had to borrow to meet the demands of applicants for service. This cannot continue indefinitely without detriment to service or a condition of additional increase of rate on Southern California Edison Company's system which will be unfair to consumers on that system." l.c. 937).

21. Brymer v. Butler W. Co., 179 Pa. St. 231, 36 Atl. 249; Pennsylvania Rd. Co. v. Philadelphia County, 220 Pa. St. 100, 68 Atl. 676, 15 L. R. A. (N. S.) 108; Ben Avon v. Ohio Valley W. Co., 68 Pa. Sup. Ct. 561, P. U. R. 1918A, l.c. 176; Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367; Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493; Re Mountain States Tp. & Tg. Co., P. U. R. 1917B, 297 (allowing, but holding the legal rate of interest not controlling).

Reason.—See note 26, *infra.*

22. Wayne Title & T. Co. v. Wayne Sewerage Co. (Pa.), P. U. R. 1919D, 404.

23. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968 (holding a return less than the lowest rate of interest sought and generally received and 1 per cent lower than the legal rate of interest not free from the objection of being confiscatory).

24. Louisville & N. Rd. Co. v. Florida Rd. Comm., 123 Fed. 947 (holding *prima facie* case for issuance of injunctive order *pendente lite* established upon showing of such return for nineteen years).

25. San Diego L. & T. Co. v. Jasper, 189 U. S. 439, 23 Sup. Ct. 571, 47 L. ed. 892 (this, however, is another subject matter).

26. See note 21, *supra.*

Legal Rate of Interest the Minimum.—"What was said in Brymer v. Water Co., 179 Pa. 231, was that the company was entitled to a fair return, not less than the legal rate of interest. In naming the legal rate the court was naming a minimum, not maximum, rate. Six per cent is the legal estimate of the legitimate profit from the ordinary safe use of money. No business man in 1846, even if now, went into a new and extensive venture of uncertain outcome without the hope of more than common interest. Because his judgment or foresight was good is no reason that he should be shorn of his profits in the result. What is a fair profit is a complicated and difficult question, but there are certain elements that are plainly to be regarded to avoid injustice, such as the original investment, the risks assumed at that time, the return as compared with other enterprises as nearly similar as may be, the cost of maintenance and improvement, the prospects of increase and present value in view of the preceding elements. Injustice is done by anything that fails to consider these and to deal equitably with the private as well as the public interest involved." Pennsylvania Rd. Co. v. Philadelphia County, 220 Pa. St. l.c. 115. (2) "If a legal rate of return was all that was offered the investor could very well answer that, without risk and with a safe margin of value, money could be loaned on lands and buildings at this rate of return. When solicited to invest in a new project, with the uncertainty of success before him, the investor demands a return commensurate with the risk involved, and that must be something more than a legal-rate investment. If the venture is a failure the investor is compelled to take his loss without any hope of recoupement; but it is equally unfair to require him to suffer all the loss if the enterprise fails, and to deprive him of the chance of additional gain if the venture is a successful one." Ben Avon v. Ohio Valley W. Co., 68 Pa. Sup. Ct. l.c. 591, P. U. R. 1920A, l.c. 176. (3) "The rate of return should primarily be based upon the actual investment in the property and should bear some relation to the rate of interest allowed by law, as that is the legislative standard by which the just return for borrowed money is fixed. . . . We wish to emphasize this by repeating that the legislative standard of 6 per cent with some margin for uncertainties furnishes a rule which in a general way should be controlling. . . . It is enough [in refusing to discuss reasons] to say that a return that barely escapes the level of confiscation will in a short time produce a condition of squalor, and squalor spells inefficiency. The return that allows rates that are unreasonably high when compared with rates from other useful lines of business in time produces arrogance, which in turn arouses hostility upon the part of the public that may lead to disastrous results." Buchanarach v. Consolidated G. El. L. & P. Co. (Md.), 14 A. T. & T. Co. Comm. L. 154, l.c. 179, 180.

27. Buell v. Chicago, M. & St. P. Ry. Co., 1 Wis. R. C. 324.

Statement.—"It has been quite generally held that a fair rate of interest is a rate which, other things being equal, corresponds to the current market rates on money. This is a position with which it is not easy to take issue, for it is quite clear that whatever rate money brings in the market is a safe index as to what it is generally worth for investment purposes. It may also be said, and with a great deal of force, that a fair rate of interest for any particular road is the rate of income which its securities bring on the market value. The market rate includes the ordinary risks, as it is usually considerably higher than the rate which is obtained on government and other securities where substantially no risks at all are involved." Buell v. Chicago, M. & St. P. Ry. Co., 1 Wis. R. C. 324, 447.

28. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574 (controlling); Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493; Milwaukee El. Ry. & L. Co. v. Milwaukee, 87 Fed. 577 (where the prevailing rate of the local market on real estate and like securities was given consideration and interest paid by the utility, which was below that which was paid on such loans, was considered the minimum); Milwaukee v. Milwaukee El. Ry. Co., 11 Wis. R. C. 1, 240; and see other cases cited (this) §5.

29. Consolidated Gas Co. v. New York, 157 Fed. 849; Wilcox v. Consolidated Gas Co., 212 U. S. l.c. 50, 29 Sup. Ct. 192, 53 L. ed. 382; Milwaukee El. Ry. & L. Co. v. Milwaukee, 87 Fed. 577.

Reason.—"Nor can I think that the legal rate of interest in the state of complainant's incorporation or operation affords any light on the subject, merely because it is established by law. As was observed by counsel equally learned in law and politics it would be easy to amend the legal rate, and judicial dependence upon an interest rate susceptible of change, by the same legislature that regulates the rate of earnings, would be, to say the least, inadvisable. There is, however, evidential value in the established rate of usance for money, in so far as it expresses the settled conviction of the business community as to the worth of capital invested in enterprises not usually considered as hazardous. . . . What would 'that prudent man acquainted with business (so familiar to the readers of legal literature) do regarding such an investment, if it were offered to him? I think he would take it, not with enthusiasm, but as fairly safe local property, promising a rate of return sufficiently above the local mortgage market to compensate for the additional and non-insurable hazard." Consolidated Gas Co. v. New York, 157 Fed. l.c. 870; approved in Wilcox v. Consolidated Gas Co., 212 U. S. l.c. 50. See also, note 43 (a), *infra.*

30. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968 (holding rates yielding 6 per cent on utility invested capital are not free from objection on the grounds of confiscation where 8 per cent is the prevailing rate on investments in banking, merchandising and other local

management (15) and subject to last participation in earnings (16), the return allowed should be sufficiently above the rate of interest demanded of the utility to attract capital (17), including that capital needed for necessary additions to the rendition of adequate service (18)—a so self-evident proposition as to demand the ready recognition of consumers (19)—as continued service at less than the cost of money will subsequently react in inadequate service or service at an unfair rate (20).

§ 4. *B. Legal Rate of Interest.*—Likewise, for an efficiently conducted enterprise, the legal rate of interest in the locality where the utility operates is the minimum rate of return to which it is entitled (21), even though such return results in temporary rates greater than the cost of a substitute for the service (22). A rate of return lower than the legal rate of interest is subject to attack on the ground of confiscation (23), and establishes a *prima facie* case for the issuance of injunctive relief *pendente lite* to restrain reductions in charges (24), such a return being justifiable only where the business has not been developed sufficiently to be remunerative or the plant has been overdeveloped to meet the probable future demands of the business (25).

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business in the vicinity, and 7 per cent the legal rate of interest).

31. Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. 925; Louisville & N. R. Co. v. Brown, 123 Fed. 946; Louisville & N. R. Co. v. Alabama Rd. Comm., 196 Fed. 800 (8 per cent); Western Ry. of Alabama v. Alabama Rd. Comm., 197 Fed. 954 (8 per cent).

Prevailing Interest Rate as Just Compensation.—(1) "When the rights of the public are protected by a schedule of just rates in that respect has the legislature the power, in the face of the provision of the Fourteenth Amendment, to go further either by express limitation in the statute or by necessary operation of the rates for which it provides, and prevent the carrier from earning any profit above a certain per centum of the value of the property, although its business be done at just and reasonable rates for the service, and without unjust discrimination? Lochner v. New York, 198 U. S. 45, 46, 25 Sup. Ct. 539, 49 L. ed 937. Has the state any such right under its own constitution? . . . The state fixes 8 per cent per annum as the rate for the use of property in the shape of loans for money. . . . The evidence shows the current rates of profit upon property used in business enterprises similar to railroads gives a net income upon the value of such property not lower than 8 per cent per annum. Whether we take the legal rate of profit by way of interest on loans of money, or the rate of profit which common experience shows to be the average, and therefore approximately a just return from the use of other forms of property, both modes lead to the same result. We can find no better standard by which to measure what is a fair and just return for the use of railroad property under the conditions governing the business of conducting railroad transportation in this state." Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. 994, 996. (2) "I think it will be conceded that so long as the rates are reasonable and do not unjustly discriminate the company is entitled to earn some amount; and it seems reasonably clear to me that if entitled to earn something under the above conditions it is entitled to earn under the same conditions a compensatory amount equal, at least, to the usual rate of interest in the locality where the railroad is situated." Louisville & N. R. Co. v. Brown, 123 Fed. 946, 951.

32. Denver v. Denver Union W. Co., 246 U. S. 178, 62 L. ed. 649, 38 Sup. Ct. 278, P. U. R. 1918C, 640 (holding rates yielding a return of 4.28 per cent in a locality where the prevailing rate of interest is 6 per cent result in confiscation of property without due process of law); Doherty & Co. v. Toledo Rys. & L. Co., 254 Fed. 597, P. U. R. 1919C, 231 (following the *Denver* case).

33. Montana W. & S. R. Co. v. Morley, 198 Fed. 991 (holding the owner entitled to such a return); Cumberland T. & T. Co. v. Louisiana Rd. Comm., 156 Fed. 823 (holding rates yielding a fair return (7 per cent are not to be disturbed).

34. Havelock v. Lincoln Tr. Co., 4 Neb. R. C. R. 91 ("No hard and fast rule can be established in respect to a fixed rate of income upon investments of this nature, but we have no hesitancy in saying that under ordinary conditions, where the good faith of the company and its fairness with respect to its patrons appears, the maximum return to such investors (provided the rate charged is not an unusual one) should not exceed 3 per cent in excess of the customary and existing rate of interest received by those whose investments are represented in fixed interest-bearing securities. In other words the building of electric lines should be encouraged and the returns upon such investments should be sufficiently large to attract capital to such enterprises. If the rate of interest on fixed interest-bearing securities in any given locality is 5 per cent a maximum return to the investors in electric railways would not be unreasonable or excessive at 8 per cent." l.c. 96. Decision dated May 7, 1911.)

35. Cedar Rapids Gaslight Co. v. Cedar Rapids, 144 Iowa 426, 120 N. W. 966, 48 L. R. A. (N. S.) 1025, 138 Am. St. Rep. 229; 223 U. S. 655, 32 Sup. Ct. 389, 56 L. ed. 549 (where a return somewhat above 5 per cent was considered free from attack on the ground of confiscation upon considering the rate of 2 per cent on government bonds, 4 per cent on state and municipal bonds and 5 per cent on utility securities).

36. San Diego W. Co. v. San Diego, 118 Cal. 556, 150 Pac. 633, 38 L. R. A. 460, 62 Am. St. Rep. 261; Consolidated Gas Co. v. New York, 157 Fed. 849; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613.

37. Bly v. Winslow El. L. & P. Co. (Ariz.), P. U. R. 1916A, 227 (10 per cent); Arizona Corp. Comm. v. Morenci W. Co. (Ariz.), P. U. R. 1915C, 546 (10-12 per cent); Ely-v. Ely L. & P. Co. (Nev.), 24 A. T. & T. Co. Com. L. 587 (holding long life and large financial transactions of utilities distinguish them from short time small loans).

Reasons.—"Such testimony [prevailing rates on local commercial transactions] has value in showing the local financial conditions, although commercial interest rates or returns in private industrial undertakings are not analogous to investments in public utilities operating without fear of undue competion and with a knowledge that the property devoted to public use will be protected in earning the rate of return found to be reasonable. Hazards ever present in private undertakings are reduced to a minimum, if not to nil, in the conduct of public utilities, such as to the one under review." Bly v. Winslow L. & P. Co., P. U. R. 1916A, l.c. 232.

38. Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367.

Municipal Bonds.—"Such investments are not by any means analogous to investments in water-works. Good bonds . . . [municipal] remain intact. They are not liable to change or diminution in the principal. At a time certain the principal is to be repaid to the investor to the last cent. If the rate paid on such investments shall determine the percentage of profit to be paid water companies there would be no inducement for anybody to invest money in works of a public nature. It would be much less wearisome to sit down twice a year and cut off the coupons from bonds. Enterprise and industrial progress would be at a standstill. It must be remembered that those who embark their capital in water companies place their property to a great extent in the hands of the public, as do all companies having the power of eminent domain. They must be always ready to supply the public demand and must take the risk of any falling off in that demand. They cannot convert their property to any other use, however unprofitable the public use may become. While they have a right to manage their property according to their own judgment they are, nevertheless, subject to supervisory powers of the courts. If the water for any reason becomes unwholesome the courts will prevent the collection of rates until it becomes reasonably pure. Nor can the companies charge any rate they please, as if the water plant were a purely private matter. Consumers have a right to appeal to the courts, who have the power to decrease the charges if they are not just and equitable. It is evident, therefore, that the rate of interest paid on city bonds is not by any means conclusive as to the return a water company is entitled on its investments." Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News l.c. 380.

39. Elizabethtown Gas L. Co. v. New Jersey Pub. Serv. Commrs.—N. J.—, 111 Atl. 729, P. U. R. 1920F, 1001; Consolidated Gas Co. v. Newton, 267 Fed. 231, P. U. R. 1920F, 483.

Government Bonds.—"The evidence in this record indicates that 8 per cent is the going rate at the present time, and that stands uncontradicted. For many months past the United States, certainly the most solvent debtor in the world, has paid either 6 or nearly 6 per cent, and other governments higher. As the facts develop in this case I need not find any rate except to say that less than 6 per cent would be insufficient." Consolidated Gas Co. v. Newton, 267 Fed. l.c. 241. See also note 54, *infra*.

40. Re Laclede Gaslight Co., 7 Mo. P. S. C. 507; Rhode Island Pub. S. C. v. Providence Gas Co. (R. I.), P. U. R. 1919B, 531, 1918 R I. 99; Omaha & Council Bluffs St. Ry. Co. v. Nebraska St. Ry. Comm., 103 Neb. 695, 173 N. W. 690, P. U. R. 1919F, 307; Re Ft. Smith L. & Tr. Co. (Ark.), P. U. R. 1920C, 419; Re Eastern Ore L. & P. Co. (Ore.), P. U. R. 1920D, 744; Re Southern California Edison Co. (Cal.), P. U. R. 1920F, 558.

Utility Credit.—(1) "The public is interested in maintaining the credit of the gas company so as to enable it to refund its securities and borrow money for improvements and additions at the lowest possible interest rates. A policy of fair dealing by the constituted state authorities will inspire confidence in the investors and eventually reduce interest rates for the securities of the utilities of the state so as to approximate the prevailing rates for municipal bonds; and unless such a result can be secured state regulation will inevitably be superseded by state or municipal ownership. Under state regulation a reduction in the interest rates paid by a utility is reflected in reduced charges for the commodity which the utility furnishes to the public." Re Laclede Gaslight Co., 7 Mo. P. S. C. l.c. 507. (2) "We believe, without the slightest hesitation, that neither the commission nor the public nor any community in this state, if left free to act, would from greed or ignorance, ever desire to take the property of the utility without compensation. They know that in the loss of these utilities the public would suffer most. The state must be careful to do nothing which may rightfully take away from it that valuable right of jurisdiction and control over its own local property and institutions." Omaha & Council Bluffs St. Ry. Co. v. Nebraska St. Ry. Comm., 103 Neb. l.c. 699. (3) "We firmly believe that the public interest requires that the credit of the utility locally owned, controlled and financed shall be maintained in order that capital may be readily available for additions and extensions, and that such credit can be best maintained by the continuance of an annual dividend rate of 8 per cent upon its capital stock, each dollar of which has been actually paid in cash." Rhode Island Pub. S. C. v. Providence Gas Co., 1918 R. I. 111. (4) "The utilities have been deprived of the power to make unjust profits; they should also be protected against unjust losses." Re Ft. Smith L. & Tr. Co., P. U. R. 1920C, l.c. 426. (5) "While this feature [poor credit] may properly be given serious consideration when shown to have resulted from unreasonably low rates, yet it is entitled to little weight when traceable to the financial policy of the utility." Re Eastern Ore. L. & P. Co., P. U. R. 1920D, l.c. 745.

41. Re Illinois Nthn. Util. Co. (Ill.), P. U. R. 1920D, 1000; Re Perth Amboy Gas L. Co. (N. J. Comm.), May 12, 1920.

Reason—(1) "It is manifest that a prosperous and well-managed utility is an asset to a community, while one able to maintain only a bare existence is a source of loss to its owner and the cause of constant irritation to the consumers of its inferior service." Re Illinois Nthn. Util. Co. (Ill.),

Again, the utility is entitled to a margin of profit above the legal rate of interest (26).

§ 5. *C. Prevailing Rate of Interest.*—Since whatever rate of interest money borrowed on the market brings is a safe index of its value (27), the prevailing rate of interest for approved non-hazardous securities in the locality affected constitutes a factor (28) of greater weight than the legal rate of interest (29) in determining the confiscatory character of rates for utility endeavor. A return lower than the prevailing rate of interest is subject to attack on the grounds of confiscation (30) and in that it denies the just compensation guaranteed by federal and state constitutions (31), although the franchises of the utility have expired and it is permitted to exist through sufferance (32). Thus, it has been expressly held that a return equivalent to the prevailing rate of interest in the locailty where the business is conducted must be allowed (33); and, whereas a return of 3 per cent in excess of the prevailing rate of interest has been considered the maximum to which utilities are entitled (34), a return somewhat above the prevailing interest charge has been considered free from attack on the ground of confiscation of property (35). It follows that the utility is not entitled to the greatest rate of interest realized upon any given kind of investment, nor is it compelled to be satisfied

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P. U. R. 1920D, l.c. 1000. (2) "That to increase rates enough to attract capital will increase the cost of living is in a measure true, but the refusal to grant sufficient rates is 'penny wise and pound foolish' and inadequate service will result, which, through indirect costs, will increase the cost of living many times the increases necessary to attract capital." Re Perth Amboy Gas L. Co. (N. J. Comm.), May 12, 1920.

42. Louisville & N. R. Co. v. Alabama Rd. Comm., 196 Fed. 800; Western Ry Co. of Ala. v. Alabama Rd. Comm., 197 Fed. 954; Home Tel. Co. v. Carthage, 235 Mo. 644, 139 S. W. 547; Wilkes-Barre v. Spring Brook W. Sup. Co., 4 Lack. Leg. News 367.

Municipal Bonds.—See note 38, *supra.*

Government Bonds.—See notes 39, *supra*, 54, *infra.*

Reason.—"Each case must of necessity depend upon the surrounding facts and circumstances. The prevailing rate of interest on money loaned, the hazard of the business, the life of the property used, the reliance upon the constancy of a return, which depends largely upon the existence or probability of competition, these, as well as many others, are proper matters for consideration. . . . It follows that unless the maximum rate be placed at such a figure that is above the average rate of return upon reasonably safe investments in private ventures capital will naturally turn to channels in which no maximum limit as to return exists." Home Tel. Co. v. Carthage, 235 Mo. l.c. 667.

Attraction of Capital.—Ben Avon v. Ohio Valley W. Co., 68 Pa. Sup. Ct. 561, P. U. R. 1918A, 161 (holding mere assurance of non-confiscation insufficient, some gain commensurate with that of other business essential); Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493 (holding investment should not be repelled or the owner embarrassed). See also note 40, *supra*, 43 (d), (3), *infra*, directing attention to a few only.

43. Wilcox v. Consolidated Gas Co., 212 U. S. 19, 29 Sup. Ct. 192, 53 L. ed. 382; Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968; Denver v. Denver Union W. Co., 246 U. S. 178, 38 Sup. Ct. 278, 62 L. ed. 649, P. U. R. 1918C, 640; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547; Puget Sound El. R. Co. v. Washington Rd. Comm., 65 Wash. 75, 117 Pac. 739, Ann. Cas. 1913B, 763 (approving 7 per cent where evidence showed 7 per cent the prevailing return on long-time first-class securities, 8 per cent on ordinary commercial paper and the company loaned money to an allied utility in the same locality for 6 per cent); Shepard v. Northern Pac. Ry. Co., 184 Fed. 765; Central Rd. Co. v. Alabama Rd. Comm., 161 Fed. 925; Consolidated Gas Co. v. New York, 157 Fed. 849; Montana W. & S. R. Co. v. Morley, 198 Fed. 991, 1009; Louisville & N. Ry. Co. v. Brown, 123 Fed. 946; Missouri, K. & T. Ry. Co. v. Love, 177 Fed. 493; Cumberland T. & T. Co. v. Louisiana Rd. Comm., 156 Fed. 823; Cumberland T. & T. Co. v. Louisville, 187 Fed. 637; Des Moines W. Co. v. Des Moines, 192 Fed. 193; Louisville & N. R. Co. v. Alabama Rd. Comm., 196 Fed. 830; Western Ry. Co. v. Alabama Rd. Comm., 197 Fed. 954; Boyle v. St. Louis & S. F. R. Co., 222 Fed. 539; P. U. R. 1916A, 49, 244 U. S. 106, 37 Sup. Ct. 577, 61 L. ed. 1022, P. U. R. 1917E, 685. And see Brunswick & T. W. Dist. v. Maine W. Co., 99 Me. 371, 59 Atl. 537; Metropolitan Trs. Co. v. Houston & T. C. R. Co., 90 Fed. 683.

(a) Statement.—(1) "Such compensation must depend greatly upon circumstances and locality, among other things, the amount of risk in the business is a most important factor, as well as the locality where the business is conducted, and the rate expected and usually realized upon investments of a somewhat similar nature with regard to the risk attending them." Wilcox v. Consolidated Gas Co., 212 U. S. l.c. 48 (frequently quoted in later decisions). (2) "Whether we take the legal rate of profit by way of interest on loans of money, or the rate of profit which common experience shows to be the average, and therefore approximately a just, return from the use of other forms of property, both modes lead to the same result. We can find no better standard by which to measure what is a fair and just return for the use of railroad property under the conditions governing the business of conducting railroad transportation in this state." Central Ry. Co. v. Alabama Rd. Comm., 161 Fed. l.c. 996. (3) "They are therefore entitled to a return which approximates the rate of interest which prevails in other lines of industry in and about that part of Montana wherein their railroad is operated. . . . Eight per cent per annum is the legal rate of interest in the State of Montana, and within 2 per cent of what bankers have testified is a rate frequently demanded upon small loans in Carbon County, Montana, in which this railroad runs. So without fixing any rate, but merely for further illustration, we will hold to 8 per cent. . . . Enough has been said to demonstrate that under the order of the commission the complainant company falls far short of enjoying a reasonable return on capital invested, not to mention the element of some uncertainty which goes with the investment, and upon which investors are justified in expecting a chance of added profit to compensate the risk." Montana W. & S. R. Co. v. Morley, 198 Fed. l.c. 1007.

(b) Qualification.—"It seems to be generally held that in the absence of peculiar and extraordinary conditions, such as a more costly plant than the public service of the community requires, or the erection of a plant at an actual, though extravagant, cost, or the purchase of one at an exorbitant or inflated price, the actual amount of money invested is to be taken as the basis, and upon this a return must be allowed equivalent to that which is ordinarily received in the locality in which the business is done, upon capital invested in similar enterprises. In addition to this, consideration must be given to the nature of the investment, a higher return being regarded as justified by the risk incident to a hazardous investment. . . . [l.c. 191. Finding none of these elements present—l.c. 200—the court holds.] Ordinarily the return generally realized upon similar investments in the locality of the one under consideration is deemed fair and guaranteed to the investor." [l.c. 189] Coal & Coke R. Co. v. Conley, 67 W. Va. l.c. 189, *et seq.*

(c) Banking, Merchandising, Etc.—"We cannot approve the finding that no return yielding as much as 6 per cent upon the invested capital could be regarded as confiscatory, in view of the undisputed evidence, accepted by the master, that 8 per cent was the lowest rate sought and generally obtained as a return upon capital invested in banking, merchandising and other business in the vicinity; 7 per cent being the 'legal rate' of interest in Nebraska. Complainant had not such a monopoly nor were its profits 'virtually guaranteed' in such a sense as to permit the public authorities to restrict it to a return of 6 per cent upon its invested capital." Lincoln Gas & El. Co. v. Lincoln, 250 U. S. l.c. 267. See also this note (d), (2), *infra.*

(d) Reasons.—(1) *Return Not Guaranteed.*—"In passing upon the question [reasonableness of return] the fact should not be overlooked that no return whatever is guaranteed the owner of the public utility. Upon that score it occupies no better ground than the owner of capital invested in private enterprise. It follows that unless the maximum rate be placed at such a figure as is above the average rate of return upon reasonably safe investments in private ventures capital will naturally turn to channels in which no maximum limitation as to return exists." Home Tel. Co. v. Carthage, 235 Mo. l.c. 667. (2) *Obligations of Regulation.*—"An investment in a bank, in a factory, in a mercantile, manufacturing or agricultural business is substantially free from regulation and exempt from any duty to the public, except that of paying taxes. If the business in which such an investment is made is unprofitable its owners may promptly discontinue its operation until more prosperous days come and then return to their undertaking. An investment in a railroad which operates in many states is subject to regulation of its business by many governments. Its owners owe the duty to the governments and to the public to operate their railroad continually in days when its operation is unprofitable as well as when it is remunerative, a duty they must discharge under the penalty of the forfeiture of their property if they fail. In view of these facts they ought to be permitted to receive a return large enough to enable them to accumulate in prosperous days a surplus sufficient to enable them to protect their property in days of disaster and to make their average return through days of prosperity and adversity fair and just. . . . The legal rate of interest on a debt in Minnesota, in the absence of a contract, is 6 per cent, and by contract it may be 10 per cent per annum. . . . Rational investments in agriculture, manufacturing, mercantile and other industrial pursuits, and even well-secured loans, yield returns in Minnesota corresponding to these lawful rates. Investments in railroads and the returns thereon are at the risk of failures and partial failures of crops, of the disasters, delays and expenses of unusual storms, snow and cold, of the great financial disasters which occasionally prevent or delay the movement of traffic, and of the burden of continuous operation, whether profitable or unremunerative. It is an axiom in economics that the greater the risk the greater must the return be upon invested capital, and the conclusion is irresistible that a net return of 7 per cent per annum upon the respective values of the properties of these companies in Minnesota devoted to transportation is not more than the fair return to which they are entitled under the constitution of the United States." Shepard v. Northern Pac. Ry. Co., 184 Fed. 765, 815, reversed on other grounds in Simpson v. Shepard, 230 U. S. 352, 33 Sup. Ct. 729, 57 L. ed. 1511, 48 L. R. A. (N. S.) 1151. (3) *Attraction of Capital.*—(a) "We are entirely satisfied that no prudent business man would willingly incur all the risks of the business and be content to earn less than that [7] per centum of profit. And while many of us would not feel entirely willing to contribute to the earning of that much income we would be much more unwilling to supply the capital for such an enterprise unless it might be allowed to earn, if it could, that much for us." Cumberland T. & T. Co. v. Louisville, 187 Fed. 637, 658. (b) "What would that prudent man acquainted with business (so familiar to readers of legal literature) do regarding such an investment, if it were offered to him? I think he would take it, not with enthusiasm, but as fairly safe local property, promising a rate of return sufficiently above the local mortgage market to compensate for the additional and non-insurable hazard." Consolidated Gas Co. v. New York, 157 Fed. l.c. 872. (c) "Capital can be attracted to these enterprises only as there is confidence that fair returns under reasonably capable management will be allowed." Omaha & C. B. St. Ry. Co. v.

with the lowest rate which capital obtains (36), on the one hand as evidenced by the rate of interest demanded on small loans (37), and on the other by that paid on municipal (38) or government (39) bonds; as the interest of the public in utility enterprises subject to regulation extends to the maintenance of the credit of the utility (40), and sound business economy, and one might add "public policy," demands that utilities be permitted to enter the money markets and successfully compete with others requiring financial assistance (41), for if rates are to be reduced whenever dividends exceed the prevailing rate of interest, investors will seek other fields where the hazard is less or the opportunity greater (42).

§ 6. *IV. Prevailing Return on Comparable Enterprises.*—For a utility enterprise conceived and conducted as those with which this article treats, the better reasoned, as well as the later, cases of controlling authority, wherein the question has been presented for consideration, hold that such utilities may confidently expect, under the constitutional guaranties, a rate of return equivalent to that obtaining in comparable (involving similar risk) enterprises of the given locality (43), such as that received in banking, merchandising, manufacturing, agricultural and other pursuits (44). This, among other reasons, because utilities are not guaranteed a return (45), are subject to all the risks of business management (46) and, in addition thereto,

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Nebraska St. Ry. Comm., 103 Neb. 700. (d) "New capital cannot be obtained by public utilities at all, except where rates are such as will afford reasonable assurance, with efficient management, of earnings sufficient to care for legitimate fixed charges and establish for them a basis of credit. This does not mean that rates should be such as in themselves will supply new capital, but that they be such as to justify capital investments in competition with other business ventures. A public utility with rates providing only a 5 or 6 per cent return cannot secure new capital in competition with private business earning an 8 or 10 per cent return." Re Georgia Ry. & P. Co., P. U. R. 1921A, l.c. 177.

44. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed. 968 (note 43, (c) *supra*); Shepard v. Northern Pac. Ry. Co., 184 Fed. 765 (note 43, (d), (2), *supra*).

45. Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547.

46. See, among many cases, note 43, *supra;* also notes 15, 26, *supra.*

47. Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613; Shepard v. Northern Pac. Ry. Co., 184 Fed. 765; Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547.

48. See note 43, (d), (3), *supra;* also notes 17, 18, 40, 41, 42, *supra.*

49. See note 38, *supra.*

50. Spring Valley Wks. Co. v. San Francisco, 124 Fed. 574; see also note 39, *supra,* 54, *infra.*

51. Consolidated Gas Co. v. New York, 157 Fed. 849; see also note 29, *supra.*

52. Home Tel. Co. v. Carthage, 235 Mo. 664, 139 S. W. 547; see also note 43, (d), (1), *supra.*

53. Cumberland T. & T. Co. v. Louisville, 187 Fed. 637, 658 (where the competing utility charged lower rates and was admittedly earning a scant return, the return received in banking enterprises was considered not controlling).

54. Lincoln Gas & El. Co. v. Lincoln, 250 U. S. 256, 39 Sup. Ct. 454, 63 L. ed 968; Elizabethtown Gas L. Co. v. New Jersey Pub. Util. Comrs., N. J.——, 111 Atl. 729, P. U. R. 1920F, 1001; Coal & Coke R. Co. v. Conley, 67 W. Va. 129, 67 S. E. 613 (holding the return must be equivalent to the prevailing rate of return: "It is obvious that the courts have not, and cannot, establish any particular rate for all concerns, all classes of business and all commodities, as a limit upon the powers of the legislature to regulate it. To some extent, therefore, every case must stand upon its own circumstances in respect to the rate to be allowed as well as the valuation upon which it is to be calculated; but the rate is obviously affected to a lesser degree by particular circumstances than the valuation to which it is applicable." l.c. 640); Metropolitan Trs. Co. v. Houston & Tex. Cen. Rd. Co., 90 Fed. 683 (an early case); Re Milwaukee El. Ry. & L. Co. (Wis.), P. U. R. 1919A, 137, P. U. R. 1920D, 319; Re Peoples Gas Light Coke Co. (Ill.), P. U. R. 1920E, 497; Re Warrensburg El. L. H. & P. Co., 10 Mo. P. S. C. 245; Re Georgia Ry. & P. Co., P. U. R. 1921A, 177; Southwestern T. & T. Co. v. Houston, 268 Fed. 878.

Reason.—"It is a matter of common knowledge that owing principally to the world war the cost of labor and supplies of every kind have greatly advanced since the ordinance was adopted, and largely since this cause was last heard in the court below. And it is equally well known that annual rates upon capital and enterprise the world over have materially increased, so that what would have been a proper rate of return for capital invested in gas plants and similar public utilities a few years ago furnishes no safe criterion for the present or for the future." Lincoln Gas & El. Co. v. Lincoln, 250 U. S. l.c. 268 (modifying decree dismissing injunction proceedings so as to permit showing of effect of change). (2) "Unquestionably the circumstances of the cost of money should be given some consideration in fixing the rate of interest which is to be allowed the utility. . . . It would not be fair or equitable to the utility itself, nor would it serve public policy, to overlook the fact that the company has been required and may in the future be required to finance some of its additions and extentions through money secured at high rates of interest. We believe that the company should have relief . . . designed to place them on an 8 per cent earning basis as related to the fair value of the property." Re Milwaukee El. Ry. & L. Co., P. U. R. 1919A, l.c. 142. (3) "The complainant in this case has to pay wages and buy materials at present advances. In such case a percentage of return in an active business in which the risks, hazard and cost of operation had been increased is much less than the same percentage in previous years." St. Joseph Ry. L. H. & P. Co. v. Missouri Pub. Serv. Comm., 268 Fed. l.c. 270. (4) "To what extent the increase in prices may be due to an inflation of the currency or to any particular cause we do not know. What we do know is that the dollar of 1919 and the dollar of 1920 is worth less than the dollar of 1916 and still less compared with the dollar of the average year from 1911 to 1916." Elizabethtown Gas L. Co. v. New Jersey Pub. Util. Commrs. N. J.—111 Atl. l.c. 730. (5) "It should be further borne in mind that because of the decreased purchasing power of the dollar a return of 8 per cent now is not the equivalent of a 6 per cent return prior to the war. Re Georgia Ry. & P. Co., P. U. R. 1921A, l.c. 177.

Government Bonds.—"In the year 1919 the rate of interest had increased so that on securities of undoubted value, such as United States government bonds, the rate of interest instead of being 3 per cent, or perhaps less, had gone up to the neighborhood of 6 per cent. Obviously in such a situation an 8 per cent return in an active business in which the risks and hazards had been increased was much less than a rate of 8 per cent in 1913 when the Passaic case was decided. No allowance seems to have been made for this increase in the rate of interest. . . . This suffices to show that the amount of return allowed to the companies would probably be insufficient under present circumstances to attract capital to the business, and this was one of the important tests of justice and reasonableness of the rate as decided in the Passaic case." Elizabethown Gas L. Co. v. New Jersey Pub. Util. Commrs. N. J.—111 Atl. l.c. 730.

55. Doherty & Co. v. Toledo Rys. & L. Co., 254 Fed. 597, P. U. R. 1919C, 230; Re Lincoln Tr. Co. (Neb.), P. U. R. 1921 B, 157.

Service Below Cost.—"From his [Mayor's] testimony and arguments submitted in behalf of the city it does not appear that he had any confidence that this rate was adequate; for he says that in fixing upon it he was moved by the theory that the car rider, the car men and the car company each must sacrifice something in the present emergency. But the Mayor of Toledo has no right to demand of this franchiseless company that it render service to the city at a sacrifice nor has he the right to say to the employees of the company that they must work for less wages than their services are fairly worth. He ignores the fact that it is no sacrifice for the car riders of the city to pay any rate of fare which is what the service to them actually costs, and the economic truths that they should pay what the service to them costs, that the car men are entitled to a reasonable wage, and that the car company is entitled to a compensation which will allow it to live. No one has the right, whether an official or not, to ask either the car men or the company to make 'sacrifices' that the car riders may get service at less than cost, and, of course, the court can listen to no such proposition as that to support an insistence that an inadequate rate should be imposed." Doherty & Co. v. Toledo Rys. & L. Co., P. U. R. 1919C, l.c. 241; and see Western U. T. Co. v. Wyatt, 98 Fed. 335.

56. Spring Valley Wks. Co. v. San Francisco, 165 Fed. 667 ("In times of financial distress, when money is very much needed and not easily obtained, rates of interest go up, and many of those who most need money are forced to throw on the market property which otherwise they would hold. When unusual quantities of property are for sale by owners who must have cash prices fall. Thus it often occurs that high rates of interest are followed and counterbalanced by lower prices." l.c. 684).

57. Winona v. Wisconsin-Minnesota L. & P. Co.—Fed.—, P. U. R. 1921A, 146; Consolidated Gas Co. v. Newton, 267 Fed. 231, P. U. R. 1920F, 483; New York & Queens Gas Co. v. Newton, — Fed.—, P. U. R. 1921A, 530; and see note 54, *supra.*

Statement.—"Two things, however, seem tolerably clear: first, that though present prices may be somewhat too high to form a proper basis as unit prices, yet it is more than probable that a plane of prices much higher than the one existing before 1914 will continue for a considerable and perhaps for an indefinite period; second, that the defendant company, a public utility, not being prevented by contract from invoking a continuous fair return on a reasonable valuation, is in a position to rightfully demand revision upward of the prices charged for gas because of present condition of high values, high operating costs and high rates of return, even though the adjustment may fit a comparatively short period of years." Winona v. Winconsin-Minn. L. & P. Co., P. U. R. 1921A, l.c. 155.

In General.—"So far as I have found in the books a test of two years is enough. In the Minnesota Rate Cases, 230 U. S. 352, 469-472, 33 Sup. Ct. 729, 57 L. ed. 1511, 48 L. R. A. (N. S.) 1151, Ann. Cas. 1916A, 14, the rate fixed by the authorities for the Minneapolis & St. Louis Railway, the only one disturbed, was set aside on an experience of only one year. In Municipal Gas Co. v. Public Serv. Comm., 225 N. Y. 89, 98, 121 N. E. 772, P. U. R. 1919C, 364, a complaint was sustained which alleged the insufficiency of a rate for a period of only two years, 1917 and 1918. In Darnell v. Edwards, 244 U. S. 564, 37 Sup. Ct. 701, 61 L. ed. 1317, P. U. R. 1917F, 64, the period was thought too short, but it included only six months, and those not including the recent era of inflation. In Rowland v. Boyle, 244 U. S. 106, 37 Sup. Ct. 577, 61 L. ed. 1022, P. U. R. 1917E, 685, a rate was upset upon a showing of only two months, coupled with opinion evidence of its being a fair test. Excepting these cases I know of no judicial ruling on what length of time is necessary." Consol. Gas Co. v. Newton, 267 Fed. l.c. 236.

Year 1919.—"The year 1919 is in this case 'a sufficient basis for the calculation of the cost of production and the "rate base" for a future long enough to call for some judicial action.' Municipal Gas Co. v. Public Service Commission, 225 N. Y. 89, P. U. R. 1919C, 364, 121 N. E. 772; Consolidated Gas Co. v. Newton, 267 Fed. 231, P. U. R. 1920F, 483; Kings County Lighting Co. v. Nixon, 268 Fed. 143," New York & Queens Gas Co. v. Newton, P. U. R. 1921A, 533.

a restriction of return under regulation (47), as well as the ever-present necessity of attracting needed capital (48). Returns on utility property should exceed the yield on municipal (49) or government (50) securities and local mortgages (51) and should not be limited strictly to the prevailing return on comparable industries of the locality (52), especially where the utility is subject to unfair competition (53).

§ 7. *V. Fluctuations.*—Fluctuations in the factors upon which the reasonableness of the return is determined justify a higher return on utility property during periods of prevailing high costs (54). Clearly, an undue shifting of the burdens brought about through abnormal conditions upon utilities is not warranted that the public at large may be somewhat relieved thereby (55). A recent increase of apparent temporary character in the prevailing interest rates is insufficient to justify conclusively an increase in the return (56), but increased rates of return, coincident with general increased prices likely to continue for a comparatively short period of time (57), are sufficient upon which to base judicial action.

Radio Serves Western Power Companies

Proves More Dependable Than Telephone Communication in Some Mountainous Regions of Far West—Useful Both for Operating and Construction-Camp Service—Sets Are Inexpensive and Quickly Installed

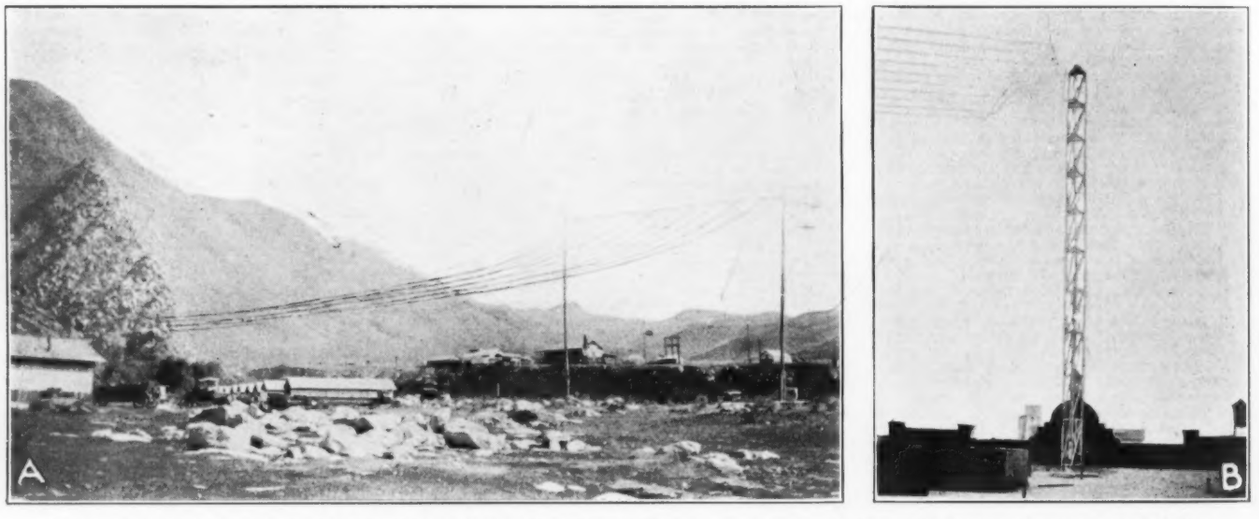


FIG. 1—RADIO COMMUNICATION PLAYS AN IMPORTANT PART IN THE CONSTRUCTION OF THE KERN CANYON DEVELOPMENT OF THE SAN JOAQUIN LIGHT & POWER CORPORATION

A—Aërial installation at Kern Canyon power house. B—Antenna on the roof of office building in Fresno.

A DEMONSTRATION of how effectively a power company can use radio was given as long ago as 1916, when the Northwestern Electric Company maintained radio communication continuously with an isolated generating station during and after a heavy storm, thus greatly expediting the repair of a serious transmission line break.* In 1917 all wireless operations by private individuals and companies were stopped by government order, but with the lifting of the ban after the war interest in the opportunities afforded by radio was greatly increased both by the much more effective apparatus developed during the war and by the larger number of men trained in the installation and operation of radio equipment.

The remote and inaccessible location of many generating plants on the Pacific Coast and the rough, unpopulated territory through which the long power lines—and hence the telephone lines also—are often carried present special inducements for Western power companies to use radio. Despite the limited experience thus far, the feeling on the Coast is decidedly favorable to radio as an adjunct to the power company's communication systems, and the common belief is that its importance will steadily increase. A résumé of features of radio systems used by two California companies is presented in the following paragraphs:

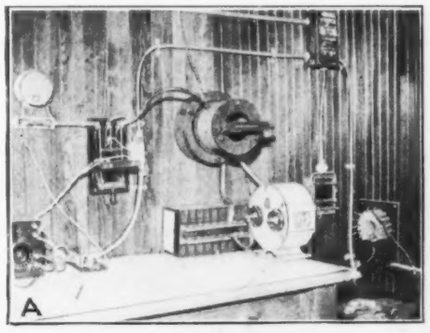
The extensions of the Southern California Edison Company's development in the Big Creek and San Joaquin River districts are being made in wholly uninhabited territory at altitudes ranging from 4,000 ft. to 10,000 ft. (1,200 m. to 3,000 m.). The snow and sleet conditions of winter time are such that telephone lines are not considered practicable where permanent reliable service is essential. The demands on the system of communication are the greater because of the complex transportation system involved. The large quantity of supplies, materials and equipment used on these operations, after leaving the railroad (construction headquarters at Cascada), is taken up an incline 7,000 ft. (2,100 m.) long with a 2,000-ft. (600-m.) rise and then over a 2-mile (3.2-km.) standard-gage railroad to the boat landing on Huntington Lake. Here the material is loaded on a barge and towed 5 miles (8 km.) to the upper end of the lake. Finally the freight

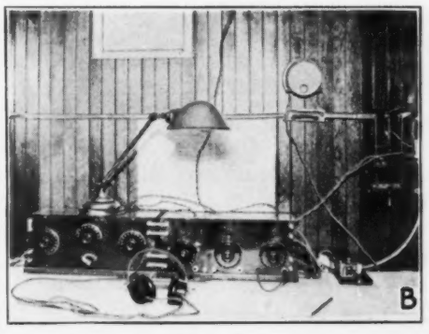
*See ELECTRICAL WORLD, Jan. 1, 1916, page 41.

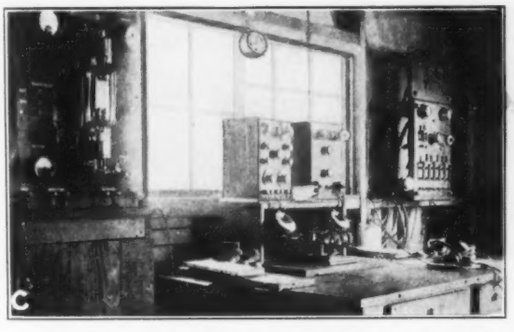
is loaded on sleds and hauled about 12 miles (19 km.) over a mountain pass 2,300 ft. (700 m.) above the level of the lake and 9,300 ft. (2,800 m.) above sea level.

When the construction work was undertaken, decision was made to establish radio communication at three points, namely, Cascada, Camp 60 and Camp 61. Cascada is at an elevation of 5,000 ft. (1,500 m.) at the head of a canyon approximately 2,000 ft. (600 m.) deep with abrupt walls on three sides. Camp 60 is at an elevation of 7,000 ft. (2,100 m.), 7½ miles (12 km.) in an air line northeast of Cascada at the head of Huntington Lake. Camp 61 is 8 miles (13 km.) in an air line northeast of Camp 60, and although only 300 ft. (90 m.) above it, is on the other side of a mountain range which is 9,300 ft. to 10,000 ft. (2,800 m. to 3,000 m.) above sea level.

Because of the high altitude and the irregular topography, as well as the meager information available about radio communication in mountainous territory, considerable experimenting was done before the radio sets were finally built. The experiments were well justified, as is shown by the fact that radio sets which gave satisfactory service in the level country around Los Angeles were found to require about ten times as much power for transmission over corresponding distances in the mountainous country.







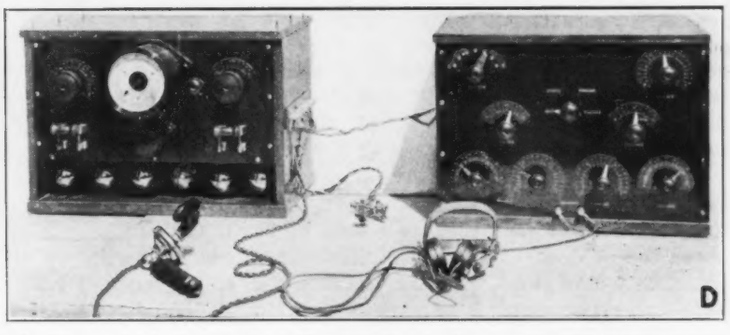


FIG. 2 — RADIO TELEGRAPH IS USED EXTENSIVELY FOR BOTH OPERATING AND CONSTRUCTION PURPOSES BY THE SOUTHERN CALIFORNIA EDISON COMPANY—TRANSMITTING AND RECEIVING SETS USED IN THE DIFFERENT STATIONS ARE SHOWN

The sets first used were of the tube type and could be employed either for the continuous-wave system or for tonal radiation, and thus served either for telephone or telegraph. The use of the telegraph was found to be the more practicable because of the comparative stability of the transmitting sets as well as its greater range under unfavorable atmospheric or topographical conditions. Although these were specially designed sets, they were built in twelve days.

The set at Cascada obtains its power for operation from the Big Creek No. 1 power plant there. At Camps 60 and 61 the sets are supplied by 220-volt, three-phase motors coupled to 32-volt direct-current generators and 1,500-volt direct-current generators. Under normal conditions the 32-volt generator furnishes power for the tube filaments and the 1,500-volt generator supplies the plates. In case of failure of the transmission line which supplies both Camp 60 and Camp 61, the power is supplied by the storage batteries of the mine locomotives which are in use at both camps. In this emergency the 32-volt generator is operated as a motor. In case of a breakdown of either the motor or the generators the radio sets may be used for telegraphic operation by means of switching facilities which use alternating current in both the filament and plates.

The antennas, which are practically the same for all three stations, consist of five No. 8 B. & S. copper conductors spaced 4 ft. (1.2 m.) apart and with 16-ft. (4.9-m.) spreaders. Large strain insulators are cut into the halyards, which consist of $\frac{7}{16}$-in. (1.42-cm.) cable. The masts for the antennas are in all cases tall pine trees which have been stripped of their branches. When experiments were under way at the outset it was found that a continuous-wave set radiating 2½ amp. antenna current at Cascada gave louder and clearer signals at Camps 60 and 61 than a damped-wave set radiating 4 amp. antenna current. The sets in use all operate on a 540-m. wave length, the normal radiation from the three stations being as follows: Cascada, 2.8 amp.; Camp 60, 1.8 amp.; Camp 61, 1.8 amp.

Only one stage of amplification is used at Camps 60 and 61. At Cascada one stage is always used and at certain times of the day, on account of local interference in the plant, it is usual to use two stages of amplification. During December, 1920, with the operators on duty eight hours a day, approximately 32,000 words were handled between Cascada and Camp 60. This included a considerable amount of private commercial communication.

The success which has attended the operation of the radio sets during the winter months under conditions where company officials regard it as doubtful if a metallic circuit could have been used have led to very satisfactory reports on the use of radio sets, and addi-

tional studies and investigations are now contemplated. The company has announced that a radio station somewhere near the proposed Colorado River development is proposed so that direct communication may be maintained between that point and the offices in Los Angeles.

When the San Joaquin Light & Power Corporation last year undertook the construction of the Kern Canyon hydro-electric development, which is 125 miles (200 km.) from the headquarters office in Fresno, telephone communication with the site was entirely inadequate. Radio communication was decided upon, and within a month thereafter two 2-kw. sets, one at the site and one at Fresno headquarters, were installed at a total cost for the two stations of approximately $750. Their operation is reported to be entirely satisfactory, and the plant is virtually being built by wireless. The stations are licensed for limited commercial operation on a wave length of 425 meters, and operators holding at least second-grade commercial licenses are required by law for their operation.

TRANSMITTING AND RECEIVING SETS

The transmitting equipment at both stations is the spark or damped-wave system. Ordinary distribution transformers of 2-kw. rating are used to raise the voltage from 220 to 6,600. Other parts of the equipment, such as condensers, spark gap, oscillation transformers, key, etc., were purchased from radio manufacturers and assembled under the direction of R. C. Denny, operating engineer San Joaquin Light & Power Corporation. The receiving apparatus used is the completely self-contained cabinet type, such as can be purchased in the open market from any one of several manufacturers. For this work a short-wave regenerative receiver was selected, and two stages of amplification were used in connection with supersensitive telephone receivers.

At the Fresno station a ten-wire inverted-L-type aërial is suspended between two 45-ft. (13.7-m.) wooden towers above the roof, making a total of 75 ft. (23 m.) above the ground. A ground is obtained by connection with the water pipes. At the power house site a ten-wire fan-type aërial is stretched between two 75-ft. poles set 75 ft. apart. As the ground conditions at this point were very poor owing to the small amount of subsoil and to a gravel bed that extended a considerable depth, a heavy stranded copper cable was buried under the aërial and a heavy lead was led thence to a pit kept filled with water.

In the absence of an alarm or calling device, a schedule of operation is fixed each morning for the coming day, the operator reporting at the beginning of the day and after clearing all business in hand setting a time not actually operating the sets the operators are kept busy at the drafting table or some other clerical work so that their time is fully employed.

Thus far, under all weather conditions, the operation of these two stations has been very satisfactory, power officials report, despite the necessity for erecting the aërial at the site not far from a high-tension line. At first some difficulty was experienced from inductive interference due to static leaks on high-voltage insulators. This was materially relieved by putting a large-capacity variable condenser in the ground lead and detuning the secondary circuit off reasonance. Of course this decreased the efficiency of the set, but since the communication ordinarily requires only about one-quarter the rated capacity of the installation, that fact was immaterial. During the summer months, when static and atmospheric disturbances are more prevalent, somewhat more power is required for operation than at other times of the year.

This company is also operating in an experimental way two radio-telephone stations and has begun the assembly of portable radio sets which are to have a range of up to 25 miles (40 km.) and will be used to keep the various construction camps in communication with the main or base camps during the construction of the Kings River hydro-electric plant. The latter camp will be equipped with a larger radio set intended for constant communication with the Fresno head office. The present indications are that during the construction of extensions to this company's system in the mountain regions radio will be depended upon as the chief means of communication.

By way of illustrating the flexibility of radio in power-company service, the Fresno operator recently reported: "During a general storm in the valley we were completely out of touch with our Bakersfield steam plant on account of both telephone lines going down. By relaying over about 20 miles (32 km.) of telephone line from the nearest radio station, we were able to communicate with the Bakersfield plant and thus render assistance to dispatchers in reaching a plant not included among those that radio was to serve."

In discussing plans for the use of radio on the system of the Southern Sierras Power Company, R. H. Halpenny, electrical engineer for that company, recently said: "Our plan now is to make use of the transmission line as an aid to wireless transmission, since previous tests disclosed the fact that by placing the aërials with a certain relation to the transmission line the effect at the receiving end was very much intensified. This method might be referred to as 'wired wireless' and is sufficiently important to be taken advantage of."

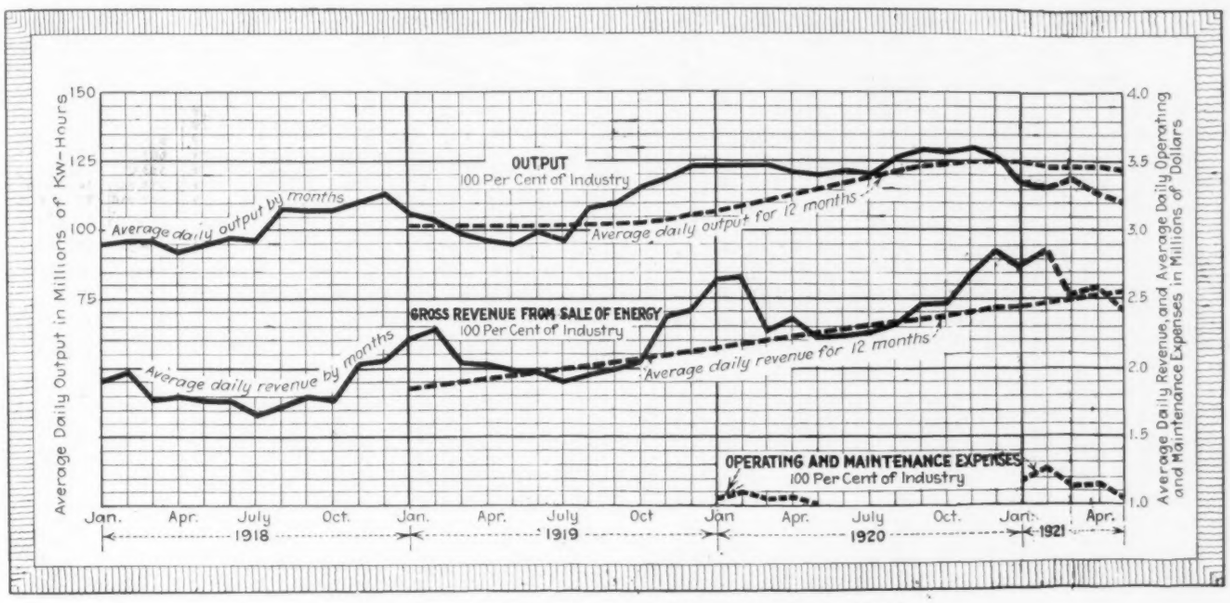
Less than 7 per Cent of Average Family Income Goes for Utility Services

LESS than 7 per cent of the average yearly income of Ohio families is spent for public utility service according to figures compiled by the Department of Home Economics of Ohio State University. This compilation shows that the actual amount spent in 1920 by the average family having an annual income of $1,500 to $6,000 for the services of the utility companies was only 6.49 per cent of the total income.

The families included in the survey spent 1.01 per cent of their income for electricity, 2.27 per cent went for street-car rides, 1 per cent for telephone service and 2.45 per cent for gas.

The compilation shows that in a family where the income was $2,700 for the year 1.78 per cent was spent for gas, 0.78 per cent for electricity, 1.33 per cent for the telephone and 1.44 per cent for street-car service. In comparison with the small amount that is spent for utility services, household budget experts of large banking concerns and industrial plants in the state estimate that 43 per cent of the average income is spent for food, 17 per cent for rent and taxes, 13 per cent for clothing and 20 per cent for miscellaneous items, such as doctors' and dentists' bills, amusements, charities, savings, books, etc. The compilation plainly shows that, although the utility services are of utmost and vital importance in the life of every one, the amount spent for them is of minor importance in the average family budget.

Slight Industrial Curtailments Continue


Average Daily Output in Millions of Kw-Hours
Average Daily Revenue and Average Daily Operating and Maintenance Expenses in Millions of Dollars
OUTPUT
100 Per Cent of Industry
Average daily output by months
Average daily output for 12 months
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily revenue by months
Average daily revenue for 12 months
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Jan. Apr. July Oct. Jan. Apr. July Oct Jan Apr. July Oct. Jan. Apr.
1918
1919
1920
1921

AVERAGE DAILY OUTPUT LOWEST SINCE SEPTEMBER, 1919

RETURNS of electric light and power operation received by the ELECTRICAL WORLD for the month of May indicate a slight decline in industrial activity throughout the country with the exception of a few sections devoted to industries largely affected by seasonal demand. The curtailment in consumption of electrical energy for power purposes was not large but was sufficient to offset the increased activities shown in some industries. The average daily output of 110,100,000 kw.-hr. was the lowest central-station output reported since September, 1919.

The most encouraging fact derived from the returns is that while the gross revenue for the month had increased by $8,500,000 over that reported for May, 1920, the operating and maintenance expenses, exclusive of interest, taxes, depreciation and sinking fund, had increased by only $950,000 for the same period. A close study of the returns indicates that this decrease in the operating ratio was confined almost exclusively to the companies having steam and combined steam and hydro-electric generating systems.

Industrial activity in New England was slightly improved during May, many of the larger textile mills operating at above 90 per cent capacity. The shoe manufacturers also reported increased activity, but other manufacturing industries in this section reported operations about on a par with those of the previous month. However, the slightly increased consumption of electrical energy for power purposes was more than overcome by the decreased lighting load due to the advancing season, resulting in an average daily central-station output of about 400,000 kw.-hr. less than that reported for April.

Production in the iron and steel industry during May was at the lowest ebb for many years, operations being reported at not more than 25 per cent of capacity. Added to this decreased energy demand by the iron and steel industry of the North Atlantic States was a strike of large proportions in the paper and printing industry of that section. On the other hand, in the South Atlantic States the textile mills, which consume more than 40 per cent of the energy sold to power customers by the central-station companies of that section, reported that only about 1 per cent of the cotton spindles were idle during May. The de-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1920 Thousand	1919 Thousand	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase
June	71	2,630,831	2,175,645	20.2	66	$44,434	$35,528	24.5
July	71	2,677,131	2,234,215	20.0	66	46,608	36,265	28.5
Aug.	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76	2,765,632	2,943,349	−6.0	70	58,855	50,861	15.8
Feb.	76	2,453,671	2,711,800	−9.4	70	55,540	48,633	14.3
Mar.	77*	2,806,609	2,989,581	−6.1	72*	55,513	49,071	13.3
April	78†	2,675,949	2,895,067	−7.0	72†	55,328	49,064	12.8
May	78‡	2,660,883	2,891,570	−8.0	72‡	53,967	47,861	12.7

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1921	Steam Plants 1920	Hydro Plants 1921	Hydro Plants 1920	Combined Systems of Steam and Hydro 1921	Combined Systems of Steam and Hydro 1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	53	18,757	17,245	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53*	17,816	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	53	17,169	16,612	3.3	55.4	56.8	24.2	22.9	40.6	44.8

*Includes estimates for thirty-nine companies, representing 4.2 per cent of the total installed rating of all central stations.

†Includes estimates for forty-six companies, representing 9.5 per cent of the total installed rating of all central stations.

‡Includes estimates for seventy-four companies, representing 16.7 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States		
		Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase
KW.-HR. OUTPUT	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905,872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
	Dec.	82	210,494	227,403	-7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	-0.3	81	556,561	550,685	1.1
	Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7.0	73	789,539	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
	Mar.	81	205,348	230,309	-10.8	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	-5.0	63	139,381	136,017	2.4	81	538,260	561,934	-4.2
	April.	81	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	73	828,457	894,028	-7.3	63	132,075	135,421	-2.5	88	555,078	586,894	-5.4
	May	82	190,971	219,294	-12.9	79	933,883	991,840	-5.8	73	820,546	901,929	-9.0	63	134,321	138,392	-2.9	89	581,162	640,115	-9.2
REVENUE			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	June	82	$4,948	$3,778	30.5	65	$16,525	$13,449	22.1	57	$12,412	$9,776	26.9	54	$2,849	$2,127	33.9	79	$7,700	$6,398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
	Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.6
	Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
	Mar.	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	15.0
	April.	81	5,665	5,554	2.0	76	21,594	18,609	15.8	60	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,819	7,767	13.4
	May	82	5,366	5,342	0.5	76	20,759	17,611	17.8	60	14,952	13,561	10.3	63	3,572	3,179	17.0	89	9,318	8,168	14.0
OPERATING EXPENSES:			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
	Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	1,963	3.9
	Mar.	45	1,576	1,651	-4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
	April.	45	1,418	1,479	-4.1	59	7,590	7,168	5.9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,894	2,479	16.8
	May	48	1,489	1,517	-1.8	56	6,919	6,652	4.0	37	4,262	4,287	-0.6	52	1,553	1,459	6.5	81	2,947	2,698	9.3

creased lighting load and the curtailed power requirements of the northern portion of the Atlantic section resulted in an average daily output by the electric light and power companies of 2,600,000 kw.-hr. below that reported for April.

Reports from the Central States indicate that factory and mill operations were about stable during May, with a probable slight decrease in the energy consumption by the iron and steel industry and the automobile and related industries. A decreased central-station daily output of 1,700,000 kw.-hr. is indicated by the returns from the Central States, much of which, of course, is due to decreased lighting requirements.

It would appear from the returns that the industrial depression has at last hit the Northwest in no uncertain manner. Reports from electric light and power companies in Washington indicate generally decreased energy requirements, these being 7 per cent under those of April. This decreased central-station load seems to be confined to the extreme Northwest, however, as reports from the Mountain section show an increased output of about 2.2 per cent. Both California and Oregon also show slight general increases over April.

Returns for the first five months of the year show that the average operating ratio of systems having steam plants only was 56.9 in 1921 and 58.1 in 1920; systems having hydraulic plants only had an average operating ratio of 24.4 in 1921 and 23.9 in 1920; and systems having both steam and hydro plants reported average operating ratio of 41.9 in 1921 and 45.7 in 1920.

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
Hydro Plants.																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.6
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Meter Policy That Has Reduced Complaints

To the Editors of the ELECTRICAL WORLD:

During the few years just past a change in the method of handling removal of meters has been inaugurated by the Minneapolis General Electric Company that has not only effected a great economy but has speeded up the service rendered very materially. Formerly where premises were vacated the meter was taken out within a very few days. The present practice is to seal the service fuses and meter and leave it in position for a period of three months unless it is evident that energy will not be used again at this address. During the year approximately 8,500 meters were sealed in this way and all but 375 of them were in service again within the three-month period, thus obviating removing and resetting in a very short time.

One of the most important features of the work is that known as "matching of orders." By this is meant a very careful and prompt comparison of installation and removal orders in order to prevent the removal of a meter after it is in service again by a succeeding tenant. This overlapping may occur by a matter of minutes and unless very carefully checked will cause a most annoying interruption of service to the consumer, and a brand new consumer at that. As an example of what may occur, Mrs. Jones comes in and leaves word that she is moving that day. An order goes through to read and seal her meter and render final bill. There being no question as to credit or other details, this type of order goes through very quickly. On the same day Mrs. Smith comes in and signs a contract for service at this location. Her order is slightly delayed for credit approval and checking for availability of service and reaches the meter department after the take-out or seal order for the same address. Without careful matching there is more than a 50-50 chance that the meterman will go there and find a meter already in. Before he can report this another man gets around and seals the meter and Mrs. Smith finds herself and family that night in a pitch-dark house. As a result the complaint which she promptly telephones in to the trouble department is in a tone that requires some diplomacy to soften if her good will toward the company is not to be sacrificed.

With the present system a mistake of this kind very rarely occurs as shown by the trouble department records. During the entire year there were only 1,890 calls that could in any way be traceable to meters or metering. By far the larger portion of these were cases where the order was received too late in the day to give service through regular channels and the troubleman was assigned to give emergency service until the following day. Taking all the work handled during the year by the meter department and spreading it over the total number of consumers, it is found that the average labor cost per consumer per year is only 63 cents.

S. B. HOOD.

Minneapolis General Electric Company,
Minneapolis, Minn.

Discussion on Inductive Interference at A. I. E. E. Convention

To the Editors of the ELECTRICAL WORLD:

May I request the courtesy of inserting in the ELECTRICAL WORLD a correction to your report of my remarks at the Salt Lake City Convention of the A. I. E. E.? At the top of page 10 of your issue of July 2, 1921, the condensed report needs correction in several particulars.

First—In reference to the matter of interference from 220,000-volt lines, I stated that telephone engineers so far as I knew were not pessimistic as to the success of superpower lines, including the ability to solve any interference problems which might arise. The inference might be drawn from your report that there extra-high-voltage transmission line over a transmission is an advantage from an interference standpoint of the line of present upper voltage practice, say 100,000 volts. This is, of course, contrary to the fact, for, with conditions otherwise the same, there would be a greater tendency for the higher voltage line to interfere, but even so I am not pessimistic as to the ability of power and telephone engineers to solve successfully any such problems as may arise.

Second—The statement that I attributed inductive interference to the transformer requires a more complete report to be understood. The discussion related to the source of triple harmonics, and I stated that past experience indicated that transformers with grounded neutrals were much the more important source, rather than corona, which was then being considered.

Third—As regards star-star-connected transformers, I stated that nothing had developed to make the star-star connection more desirable from an interference standpoint; it has always been undesirable on account of its relatively large tendency to cause triple harmonics in the line. I stated that the addition of the tertiary delta winding is beneficial, just the opposite of your report, and that a still better connection is the full delta star, since that gives a larger capacity (lower impedance) delta for shunting triple harmonics from the line.

Fourth—In reference to shell and core type transformers my exact words were: "As regards the production of third harmonic neutral and residual currents, the three-phase core type transformer in particular cases may not have any particular advantage over the shell type or three single-phase units."

At the bottom of page 12 you refer to my discussion of Mr. Lewis' paper. That discussion pointed out that the data of the paper itself were sufficient to throw out the transformer hypothesis for the source of the triple harmonics observed in those tests. I also showed calculations based on the assumption of the line as the source which agreed very well with the observed results of test 44 and explained the inconsistency in Fig. 22 pointed out by Mr. Lewis. Contrary inferences might be drawn from your report.

LIVINGSTON P. FERRIS,
Department of Development and Research.
American Telephone & Telegraph Company,
New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Recent Central-Station Equipment Costs

FROM a tabulation of equipment costs presented to the Massachusetts Department of Public Utilities by one of the larger companies supplying electric service the accompanying items are taken because of their usefulness in plant estimates. As a rule these items are quoted at the factory or warehouse price, freight and installation charges being extra. The apparatus listed was purchased during the periods indicated in the table, which covers the time from December, 1918, to March, 1921.

RECENT COSTS OF CENTRAL-STATION EQUIPMENT

Items	Cost
Dec. 1, 1918, to June 30, 1919.	
One 12-in. Badger expansion joint	$80.00
Eleven Bailey boiler meters, type D 22	5,970.03
Three diaphragm recording vacuum gages	110.88
One 1000-amp. d.c. ammeter	36.56
One power-factor meter	54.45
One 5-amp. a.c. ammeter	19.13
One 300-amp. 15,000-volt oil circuit-breaker	251.00
Three 1,000-kva. single-phase water-cooled transformers	6,870.00
One 75-light 6.6-amp. mercury-arc rectifier with panel	1,359.00
July 1, 1919, to June 30, 1920.	
One 24-in. ring master pilot gage, double illuminated dials	240.00
Six pieces wire screen, 11 ft. 10 in. by 16 ft. 6 in.	110.00
Six Negus-Tiffany coal agitators, installed	2,046.77
One 10-in. Foxboro recording thermometer	58.84
Twelve 60-cycle I-A overload relays	273.60
One 60-kw. 2,300-volt I.R.S. regulator	1,681.68
Two 46-kva. 2,300-volt I.R.S. regulators	2,448.60
One special type F phantom load, 75 amp., 600 volts	90.75
Two 3,600-4,680-volt aluminum lightning arresters, outdoor type	900.00
Thirty-five 4-amp. magnetite arc lamps	1,530.00
Twenty-four 6.6 amp. luminous arc lamps	1,296.00
July 1, 1920, to March 31, 1921.	
Two Negus-Tiffany coal agitators	1952.18
Three underfeed stokers, fourteen-retort	33,600.00
Three Bigelow boilers, 1,266 hp. each (not installed)	87,580.00
Two Cox "B" stokers	16,510.86
Two Detrick arches for stokers	2,020.00
Three Foster superheaters	20,900.00
Two size "A" condensation meters	52.00
One 500 5-amp., 110-volt polyphase watt-hour meter	60.50
One three-way ammeter switch	12.41
One eight-point potential receptacle	2.19
Two eight-point potential receptacles, synchronous type	25.80
Two 1,000-kva. Pittsburgh single-phase 13,200 to 2,300-volt transformers	5,990.00
Two 300-amp. 15,000-volt type F K oil circuit breakers	465.92
Two overload attachments for circuit breakers	17.92
Fifty I-A induction relays	1,320.00
One Frahm switchboard frequency meter 52.6 to 67.5 cycles	79.75
One K-20 oil circuit breaker for 20-hp. 220-volt motor	82.60

FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

Experience with Grounded Pins and Crossarms

A STUDY of the effect of grounding insulator pins and hangers and crossarms was discussed at a recent meeting of the Northwest Electric Light and Power Association. Briefly summarized, the conclusions from the data collected are as follows: For wood crossarm construction, opinion and practice are nearly unanimous in favor of ungrounded insulator pins and hangers, irrespective of voltage or of whether or not the system neutral is grounded. Widespread experience has shown a definite and important superiority in insulator performance, arising both from lessened dielectric stresses and from less likelihood of damage in case of insulator flashover. Insulators of much higher rating appear to be necessary to give even approximately as satisfactory performance when pins are grounded. Trouble from burning of crossarms or poles with ungrounded pins appears to be inconsiderable except under exceptional climatic conditions such as those obtaining in California.

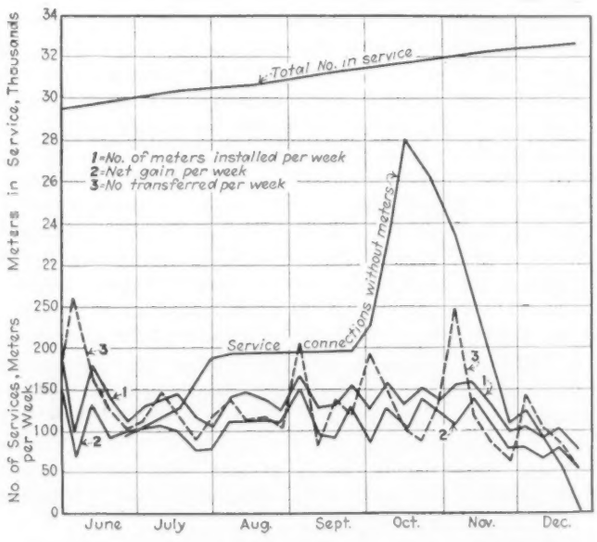
For steel crossarm construction on wood poles experience appears to be about equally divided as to grounding of arms. In some cases there has been trouble from burning of the pole at point of attachment if the arms are not grounded or bonded together. Apparently sound practice would be not to ground steel arms unless experience under the particular conditions obtaining has shown grounding to be desirable.

FIELD EDITOR ELECTRICAL WORLD.

San Francisoo, Cal.

Curves Aid Meter Department in Keeping Records

IN ORDER to show the progress of the meter department's work graphic records are charted weekly by the Worcester (Mass.) Electric Light Company's distribution department. This curve sheet shows the number of meters installed during each week, the net gain per week, the number transferred and the total number of meters in service. Another curve, No. 5, shows a temporary condition. This shows the number of service connections at the end of each week on which no meters were installed on account of inability to obtain them in large enough number from the manufacturers. It will be noted that in the month of December, when



WORK OF THE METER DEPARTMENT IS EASILY VISUALIZED BY CURVES SUCH AS THESE

meters were received in larger numbers, the curve dropped to zero.

Curves of a similar nature have been prepared for helping the management of this company in several ways. Some of them have already been described in ELECTRICAL WORLD, and more will be shown in later issues.

J. M. HARDY,
Superintendent.

Worcester Electric Light Company,
Worcester, Mass.

Some Methods Used to Clean Condenser Tubes

CLEANING condenser tubes is a problem on which various methods have been tried with different degrees of success, depending on the deposit found in the tubes. The baking method has been successful where the deposit is light and gummy. The circulating water is cut off and steam turned in to bring the temperature up to about 212 deg. This bakes the light deposit and it curls up. When the circulating water is again brought up it washes the tubes clean. This method is rather dangerous as the shell may be cracked or stay rods broken due to unequal expansion. However, it is a quick, effective method and is used successfully in many plants.

The brushing or scraping method is a common one. The early attempts were by using brushes or scrapers on rods and running them through by hand. This took a long time and the labor cost was excessive. Later, plugs were developed, soft rubber plugs, rubber plugs with abrasives, plugs cut from packing with nails driven through them, plugs with flat coiled steel springs, plugs with wire brushes, which were shot through the tubes with air or water. This cut down on time and labor and gave as good results as scrapers. In many cases where soft rubber plugs were used it was found that a hard scale would gradually form on the tubes and the heat transfer would be cut down as much as 200 B.t.u. A method of removing this hard scale was then necessary. Sand blasting has been used with fair success. Tubes have been sand blasted in place, the sand blast being so rigged that four men could work at once. The turbine-driven revolving cleaner, similar to the boiler-tube cleaner, is also used, but in tubes 20 ft. long and 1 in. diameter this process is found to be very slow and tedious. At first there was danger of cutting the tubes but lately cleaners have been developed which do not touch the tubes.

Chemicals are used to some extent, more in England than in this country. Solutions of caustic soda or acid have been used to loosen the scale. Hydrochloric acid from 5 to 40 per cent has been circulated through the tubes and then they were thoroughly washed out. Caustic soda from 1 to 7 per cent has been used successfully. This method is expensive and requires careful attention or the tubes will be ruined. In many cases too the scale is not touched by either chemical.

Washing the tubes with high-pressure water is done in many plants successfully. Pressures up to 250 lb. are used and in many cases it is found that it takes the high velocities to cut the deposits off. In some cases, however, merely increasing the circulating-pump speed will clean out the tubes. Some European installations have an arrangement of flap valves whereby some of the tubes may be cut off, this increasing the head on the remaining tubes and washing them clean.

An interesting method, recently patented, for cleaning tubes without disturbing operation whatever has been developed by one of the large condenser manufacturers and according to their report has proved successful on all installations that have been made. This consists of washing the tubes with high pressure water—250 lb.

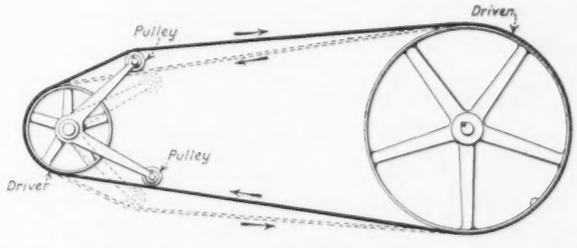
Long lance-like steel tubes connected by hose to the supply pump are stuck through special close-fitting swivel valves arranged in the water box heads. The end of the lance comes about ½ in. from the ends of the condenser tubes and is then swung back and forth over the group of tubes. The water at 250-lb. pressure knocks all the deposit off the tubes and the flow of circulating water washes it out. This method will not remove scale already deposited in the tubes, but it is claimed will prevent the formation of any scale. This is probably the only method for cleaning tubes of a serious deposit which does not interfere with the operation.

This information was contained in a paper read before the station operating committee of the Ohio Electric Light Association by A. Carnegie of the Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Taking Up Lost Motion in Waterwheel Control

ONE hydro-electric station in New England experienced a great deal of trouble from excess play in the rope drive between waterwheel governors and the wheel gates. These rope drives are in almost constant motion, driving first one way and then the other, thus alternating the tight and loose sides of the belt. This meant that a certain amount of slack rope had to be taken up each time the direction of motion was reversed. It was impossible under such conditions to set the governors at a given opening and be sure that the opening of the gates would correspond.



IDLER TAKES UP SLACK IN ROPE DRIVE INDEPENDENT OF DIRECTION OF DRIVING

The illustration shows the double idler devised to meet the problem. A hub with a bearing slightly larger than the governor shaft, to permit of free movement, branches out into two arms set at a predetermined angle. These arms in turn support the two smaller idler pulleys. Dotted lines in the illustration show the positions of the idlers and drive ropes in the two directions of motion.

With this arrangement there is practically no lost motion and the setting of the governor now regulates to a close margin the opening of the gates.

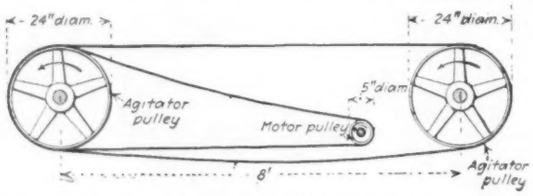
New York, N. Y. E. L. BRAGDON.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Double Belt Drive That Occupies Minimum Space

A SIMPLE belt drive that occupies minimum space is used in the French government fish-freezing plant at St. Pierre, Miquelon. In this plant two pulleys of 24-in. diameter are direct-connected to agitators on an ice tank and operate at about 220 r.p.m. They are driven by 2-hp., 220-volt, two-phase, 1,200-r.p.m. induction motor. On account of space limitations the motor is set between the two large pulleys and belt-connected to one. On the same shaft with this pulley is another which drives a belt on the second agitator.



SPACE IS SAVED BY PLACING MOTOR BETWEEN LARGE PULLEYS

As the motor is only a 2-hp. machine it is started by throwing it directly across the line. On account of the short centers there is some slippage, but teasing the motor overcomes this. This practice is not very objectionable because the motor is small and when once started runs for several days without stopping.

EUSTACE C. SOARES,
Ophuls, Hill & McCreery, Inc., Electrical Engineer.
New York City.

Peculiar Trouble on Ungrounded Three-Wire System

TROUBLE which may result from a three-wire system without a grounded neutral was well illustrated in a case which recently came to the writer's attention. This plant has a 115/230-volt three-wire Edison system and, as stated, had at that time no ground on the neutral wire. One morning it was noticed that half of all the lamps on the poles in the yard were burning in broad daylight. All these lamps which were burning were connected on one side of the three-wire circuit while the remaining lamps in the yard, which were not burning, were connected on the other side. It was supposed that the engineer had forgotten to turn them off and that a fuse had blown, but investigation showed that the circuit switch was open.

After some investigation a ground was found on the negative side of another three-wire circuit supplying lamps along a railroad trestle. This circuit switch was opened and the lamps on the yard circuit went out. Likewise a ground was found on the negative side of the yard circuit. These two grounds explained the behavior of the lights.

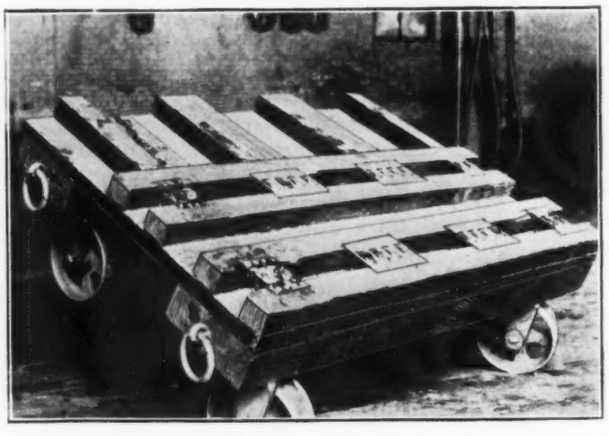
Owing to the fact that there was a ground on the negative wire of the track circuit and also a ground on the negative wire of the yard circuit and because the neutrals of all circuits are connected together on the back of the switchboard, everything was all right as long as both the yard lighting switch and the track lighting switch were either on or off, but when it was desired to throw off the yard lamps while the track circuit switch was in, current from the live negative wire of the track circuit passed through the ground to the grounded dead negative wire of the yard circuit, then through the lamps connected on that side to the neutral of that circuit and back to the switchboard, where this neutral was directly connected to the neutral of the track circuit.

Shortly after this the neutral wire was grounded according to standard rules of the National Board of Fire Underwriters and such unusual trouble as this has not reoccurred.

RAYMOND N. COFFMAN,
Heath Refinery, Chief Electrician.
Heath, Ohio.

Trucks to Facilitate Work of Handling Vehicle Batteries

IN ORDER to make the handling of batteries easy in the vehicle department of the United Dressed Beef Company, New York City, a small truck with rollers mounted on top, as shown in the accompanying illustration, has been developed. The truck is built as shown with 3-in. x 4-in. pieces screwed on top of it. Into these pieces are fitted rollers about 2 in. in diameter. The truck is pushed up to the battery box on the vehicle, the floor of the box coming just level with the top of the small truck. Then the trays are pulled out, one at a time, on to the truck, this operation being made easy by means of the rollers in the top of the truck.



BATTERY TRAYS ARE ROLLED OUT ON TOP OF TRUCK AND EASILY TRANSPORTED TO REPAIR ROOM

In the photograph, one edge of the truck is raised in order to show the top more clearly.

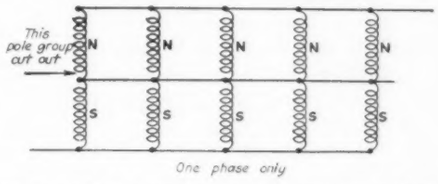
The truck accommodates three trays. Into each end of the truck two rings are fitted. By means of two iron hooks placed in the rings the truck may be easily pulled where desired. The truck is pulled from the vehicle into the repair room, and the battery is left upon it until it is repaired and ready to be taken back to the vehicle.

To prevent the acid from destroying the wood a coat of black acid-proof varnish is given to the truck.

A. M. CAMPBELL,
Foreman Battery Department.
United Dressed Beef Company,
New York, N. Y.

Trouble Resulting from Cutting Out Coils in Induction Motor

WHEN two coils were found short-circuited between themselves on a ten-pole induction motor, the first attempt to remove the trouble was to open these two coils and reconnect the coil group from which



FIVE-PARALLEL CONNECTION OF TEN-POLE MOTOR

they came. This was a six-coil group on a ten-pole machine which was connected in five-parallel, one-phase of which is shown in the accompanying drawing. When these two coils were cut out of the group and the four coils used instead of six, the result was that these four coils overheated in a very short time. This was because the voltage upon them was too great and too large a current flowed in them. The remedy was to disconnect this entire coil group from the motor section. The motor operated satisfactorily after this was done until new coils could be put in. E. R. DEBMAN.

East Orange, N. J.

Bolts and Nuts Must Be Kept Tight on a Motor

PERIODIC examination of the base bolts of a motor is necessary, as vibration and the jerk of the belt, chain or gear are likely to loosen them. If bolts persist in loosening, they should be replaced by longer ones having a locknut and perhaps a cotter pin. Lag screws should not be used for suspended motors. The base bolts holding down a gear-driven motor must be tight to permit the gears to mesh at all loads. The nuts of the brush-holder studs of direct-current motors should be tightened once in a while, since they will loosen from heat and vibration. Bolts protruding from the frame of direct-current motors, holding the pole pieces, should be tightened once in a while, because vibration is liable to loosen the poles and perhaps allow them to strike the armature.

When the motor is stopped examine the set screws in the pulley. If they repeatedly loosen, use longer ones with cup ends and with a hexagon nut turned down tightly against the hub. With direct-connected motors see that the coupling bolts are tight, or a nut may fly off the motor when it is running. H. S. RICH.

East Berlin, Conn.

Thorough System of Baking Coils, Armatures and Stators

A THOROUGH system of impregnating and baking motors and coils has been found fully to justify its adoption because of the increased reliability of the motors repaired by the Airedale Electric & Manufacturing Company, Ltd., Bradford, England. For machines above 15 hp. having open slots the coils are fully insulated for the working voltage before being inserted, in which case the cotton-covered wire is run through a special tank containing air-drying varnish as the coils are being wound. This tank is fitted with a wiper to remove varnish not absorbed by the cotton covering. After being wound and having slot insulation applied the coils are taped with cotton tape which has been previously impregnated in the bulk. The foregoing precautions are taken because experience has proved that if the wire and tape are left in their natural state (white) and the coils immersed in an impregnating tank, the varnish does not penetrate through the slot insulation, but leaves portions unimpregnated.

The coils are next pulled to the required shape and size, then placed in an oven and baked for twenty-four hours, after which they are placed in an impregnating tank while hot and allowed to remain until all bubbling has ceased. They are then removed and hung over the tank so that the superfluous varnish drips back into it.

The oven is steam-heated and kept at a temperature of 180 deg. Fahr., the heat being regulated by means of a damper in the chimney through which the fumes pass out to the atmosphere. The varnish is also heated to a similar temperature by means of a steam coil placed at the bottom of the tank. The joints of the coil, in addition to being screwed, are welded as a precaution against leaking. This coil is easily removed from the tank for cleaning, etc., by means of a union joint placed well above the tank.

COILS ARE BAKED FOR FIFTY HOURS

After dripping for one hour the coils are put into the oven and baked for a period of fifty hours. Judging from the outward appearance, they appear at this time to be perfectly baked, but on one occasion when it was necessary to remove the outer insulation from a set of coils it was discovered that the inside turns were almost as wet with varnish as though they had not been baked. From that time on all coils of this type, after being treated in the same manner, were dried out after they had been placed in the slots of the machine by passing current through them. The phases are connected in series so that the current traverses the whole of the coils. For this purpose a 10-kw. single-phase transformer is used having secondary voltages of 55, 110 and 220 volts, the various voltages being used according to the current required for a particular winding. A tarpaulin is placed over the whole machine which is allowed to reach a temperature of 180 deg. Fahr., the temperature being controlled by uncovering a portion of the machine.

For machines having mush or pull-through windings with semi-closed slots, the wire is impregnated before use, the end winding taped with previously impregnated material, then sprayed with air-drying varnish and baked in the manner previously described (by current) for a period of forty-eight hours.

For motors not above 15 hp. in size the wire, tape, insulation, etc., are left in their natural state (white)

during the process of winding. When winding is completed the stator is placed in the oven and baked for a period of twenty-four hours, then placed bodily in the impregnating tank and allowed to remain until bubbling ceases. It is then suspended above the tank for half an hour to drip, then turned over so that the varnish runs into the windings. During the time allowed for dripping the varnish is cleaned from the stator casing. The stator is next placed in the oven and baked for fifty hours.

Insulation tests are taken by a 1,000-volt, 200-megohm megger at the following times: (1) Before any heat is applied immediately after winding; (2) while hot and before impregnation; (3) while hot and after impregnation and baking, and (4) when cold. When apparatus is thoroughly baked an "infinity" reading should be obtained, *i.e.*, 200 megohms. As a safeguard against the possibility of weak spots a voltage of at least three times full normal working voltage is applied for five minutes.

L. E. WOOD.
Airedale Electrical & Manufacturing Company, Ltd.
Bradford, England.

Electric Furnace Costs Better Oil-Heating Figures for Hardening Tools

A COMPARISON between the cost of maintaining working temperature in an electric furnace for tool hardening and the expense of operating an oil-fired furnace in similar work was recently presented by H. W. Derry, power engineer Hartford (Conn.) Electric Light Company, before the Power Division of the New England Geographic Division, N. E. L. A. The data showed that for comparable service the electric furnace maintained the required temperature at about 50 per cent of the cost resulting from the use of the oil furnace. Tests were run on furnaces having about the same hearth area and doing the same kind of work at the same temperature. The results shown in the accompanying table were attained.

ELECTRIC FURNACE COMPARED WITH OIL-FIRED FOR TOOL HARDENING

ELECTRIC FURNACE	
Inside dimensions	30 in. wide, 36 in. long, 22 in. high
Rating of furnace, kw	20
Days' run covered by test	19
Total working hours	107
Total weight of steel heated, lb	1,451
Temperature, deg. Fahr	1,450
Average kw.-hr. per hour in working hours	8.96
Average kw.-hr. per hour empty (radiation loss only)	3.04
Fuel cost per hour at 1.25 cents per kw.-hr., cents	10

OIL FURNACE	
Inside dimensions	46 in. long, 25 in. wide, 20 in. high
Average temperature held, deg. Fahr	1,400
Specific gravity of oil at 60 deg. Fahr	0.8
Degrees Baumé	32.79
Total time test was run, hours	46
Total gallons of oil used	84
Weight of steel heated, lb	2,670
Total time heating steel, hours	31.75
Average gallons per hour heating steel	1.9
Average gallons per 100 lb. of steel	2.26
Time furnace was empty (holding temperature only), hours	14.25
Average gallons per hour, holding temperature only	1.65
Fuel cost per hour at 14 cents per gallon, cents	23.1

The electric furnace was provided with automatic temperature control and a time switch for throwing off the power at the end of the working day and switching it on in the early morning, so that the furnace was always ready for use. The repair cost for the electric furnace was practically nil.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Troubles on Compensators Which Should Be Checked at Start

A NUMBER of troubles may develop on compensators which will not cause serious damage if they are checked in time. In the case of a motor refusing to start and the load being such that it is inconvenient to remove, raising the taps to some higher point will remedy the difficulty provided that the motor is not at fault or the load is not too heavy. A buzzing sound in the windings will denote either loose laminations or a ground. If the laminations are loose they should be wedged tightly together. In case of a ground it must be located and removed or the coil will burn out. The action in this case is peculiar. One side of the transformer is always connected to the line, and a ground will cause a current heavy enough in most cases to heat the windings and cause them to burn out, while at the same time it grounds one phase of the motor and acts as a ground on the motor, besides unbalancing the phases. About the only way to remove a ground from a compensator coil is to replace the coil with a new one. A short-circuited coil will probably do no more damage than speed up the motor too quickly on starting, while an open-circuited coil will seldom be met with.

A rumbling noise in the oil tank denotes a bad contact. Press the contact jaws together, add more tension to the springs, or if too badly pitted or burned renew the contacts. Heating of the oil tank denotes the presence of water in the oil. Remove oil at once and refill with fresh oil.

The presence of a burned-out low-voltage coil will be denoted by the plunger remaining down when the compensator is energized. However, this may indicate other trouble on a compensator equipped with overload relays as the circuits of the relays and the low-voltage coil are interconnected. A loose connection on the relay mechanism will cause the plunger to remain down or inoperative. Hammering of the plunger will denote that the circuit from the overload relay is being made and broken at intervals because of a loose or burned connection. This will trip the operating lever in time.

It is sometimes impossible to get the compensator handle to stay in the operating position owing to the relay or relays being stuck in a high position. This may be caused by the oil in the dashpots becoming too thick or being too thin, or from a ground. Thickened oil may be detected by the resistance offered when forcing the relay to its right position. Changing the oil or setting the relay to a lower setting will overcome this difficulty. If the oil is too thin the relay acts too quickly and cannot drop back. To overcome this defect use thicker oil or raise the setting or time limit. If there is a ground present, it will be noticed by the inability to move the mechanism and by a puncture in some part of the mechanism where it has become welded to some other part.

In case of serious trouble where it is necessary to keep a motor in operation and where no spare starter is available, an emergency starter may be made. For either two-phase or three-phase induction or wound-rotor motors a couple of pails, wooden preferred, are secured, or if these are not available, use metal pails, being careful to insulate them from each other and from the ground. Fill the pails with water and place a large washer or floor flange in the bottom of each pail and connect a wire from the flange to the motor. The other two lines should be attached to two flanges.

Hold these two lines apart. It is well to hold them by means of a cord to avoid receiving a shock. Drop first one and then the other slowly in the water. As soon as the second touches the water the motor will rotate. Gradually lower the flanges until they touch the flanges at the bottom of the pail, when full line voltage is applied. While running, the pails should be shunted by a knife switch of ample size. This method is safe and takes only a few minutes to put into operation.

Provincial Paper Mills, Port Arthur, Ontario. H. E. STAFFORD, Electrical Engineer.

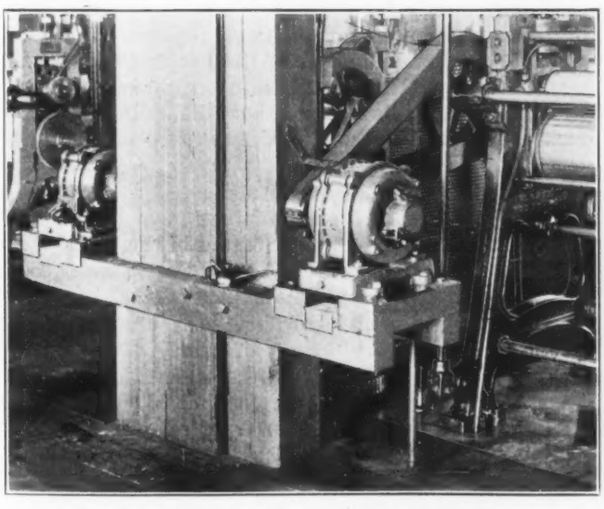
Oil in Large Motors Requires Filtering

IF A LARGE motor is isolated, a small semi-batch filter should be used to purify the oil, the oil being withdrawn at intervals and passed through the filter. If, however, the motor is used in connection with drive-shaft or reduction-gear bearings, the oil should be passed through the circulating system used for these other bearings. Overflow sights should be placed in the line from the motor-bearing reservoir to maintain a predetermined oil level.

Carver Wood embodied these remarks in a recent article in the *Journal* of the American Society of Lubricating Engineers.

Mounting Motors on a Wide Column

ECONOMY of floor space and a symmetrical drive of two embossing machines is secured in the plant of the Springfield, (Mass.) Glazed Paper Company by mounting the motors on a home-made bracket bolted to a column 2 ft. 10 in. wide, as shown in the accompanying illustration. Two 3-hp. General Electric three-phase, 440-volt induction motors are required, one running at 1,200 and the other at 1,800 revolutions per minute. The motors are provided with high-resistance



TWO MOTORS MOUNTED CLEAR OF FLOOR

rotors to allow starting under load, and the embossers are driven by Link-Belt chains. The motors are mounted on 3½-in. x 3½-in. base blocks attached by 1-in. bolts to 3½-in. x 6-in. timbers similarly bolted to the columns. This arrangement provides for easy inspection with a well-balanced mechanical drive, without the inconvenience of avoiding the motors during floor cleaning.

Springfield Glazed Paper Co., West Springfield, Mass. J. H. WHITEHOUSE, Superintendent.

Systematic Temperature Records Reduce Motor Operating Troubles

FOUR temperature readings daily are taken on each group-drive motor by inspectors for the electrical department of the Amoskeag Manufacturing Company, Manchester, N. H. Preventive inspection has cut down operating failures of motors to less than two in six months in the mill, where as a whole about 2,000 motors are in service, ranging in size from ¾ hp. to 300 hp. Temperature records are kept on 4-in. x 10-in. loose-leaf sheets as shown, two sets of sheets being used daily for each group of motors. All motors are numbered, and if the temperature exceeds 150 deg. F., it is brought to the attention of the chief electrical engineer of the company. Space for current readings is also provided on these forms. About 1,200 motors are in service on group drives. Ten men are regularly engaged in motor inspection in this plant. The temperature records are regularly checked by the electrical department.

Amoskeag Manufacturing Company

TEMPERATURE OF MOTOR

NORTHERN DIVISION May 25 1921

Motor No.	11 A. M.	3 P. M.	AMP.	Motor No.	11 A. M.	3 P. M.	AMP.
103				158	142		47
104				159	125		
105				160	125		43
106				161	143		43
107				162	147		46
108				163	156	X	60
109				164			
154	119		8	209			
155	120		27	210			
156	122		28				
157	122		26				

P. Linhorn Motor Inspector

TEMPERATURE OF MOTORS IS RECORDED FOUR TIMES A DAY IN THIS SHEET

F. L. CLARKE, Chief Electrical Engineer.

Amoskeag Manufacturing Company, Manchester, N. H.

Spare Motor-Driven Exciter Saves Shutdowns

BY COUPLING a spare reserve exciter to a motor, interruptions to production have been prevented in a large cyanide mill where two synchronous motors are used for stamp-battery drive. Each of these synchronous machines has its own exciter belted to it. A spare exciter has always been kept in readiness to replace either exciter should a defect develop. The exciters are so located that they are rather difficult to reach for substituting the spare. Considerable time was usually lost in taking out a defective machine and replacing it.

A motor of the proper size becoming available, it was decided to make a flexible coupling and to mount the spare exciter and the motor on a base for use as a motor-generator set. A three-pole double-throw switch was provided and an equalizer bus was run to all three machines.

With this arrangement it is now possible to furnish exciting current from the motor generator set to either of the two synchronous motors. When trouble occurs in the exciter of one or the other, it is a simple matter to start up the set, bring the voltage of the generator up to that of the exciter to be cut out, throw the switch to the proper side and slip the belt of the defective exciter. Repairs can then be made whenever convenient.

FREDERICK KRUG.

New York & Honduras Rosario Mining Company, San Juancito, Honduras, C. A.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Publicity to Prevent Breakage of Street Lamp Globes

ACCORDING to the records of the Rochester (N.Y.) Gas & Electric Corporation the number of broken street lamp globes has increased from year to year until the loss now approximates $17,000 a year. Though the company has made every effort to reduce this loss by the use of strong globes and secure fastenings, it is estimated that fully one-half of the total breakage is due to mischief and careless driving. It was believed that this could be reduced only with the co-operation of the public.

PRIZE WINNING POSTER NEEDS NO EXPLANATION

With this in view the company arranged with authorities of the public and parochial schools to distribute educational literature to each pupil showing the money cost and damage to life that resulted from broken globes. In keeping with this plan, a poster-drawing contest was conducted by the Mechanics' Institute in which mischievous breakage of globes was opposed. Prizes were given by the company for the three best posters. First prize was won by the poster shown here, entitled "It's Not Fun," by Roy Miller, and it was decided to reproduce the drawing in full color on 7½-in. x 5½-in. posters for distribution among the school children of Rochester.

While the plates and run of 60,000 impressions of the poster were being made the school authorities were planning to devote a definite time throughout all the schools to a study of this phase of civic instruction. Distribution of the posters was made so that this lesson was assigned for Friday, June 3. The reverse side of the poster carried the accompanying message from the Rochester Gas & Electric Corporation and formed a nucleus about which the teacher's lesson could be built.

Perhaps no more opportune time could have been selected for the campaign than that last week of school before the summer vacation months. That the campaign will be successful in reducing the number of lamp globes broken through mischief is attested by the hearty co-operation promised in class letters received by the company and in letters from a large number of the school children.

Breakage of Street Lamp Globes

THIS poster received the winning prize given by The Rochester Gas and Electric Corporation in a contest conducted by Mechanics Institute.

It illustrates unnecessary suffering caused by the mischievous breakage of street lamp globes. The company desires through it to arouse interest so that globes will not be carelessly broken.

Many of the city's street lights require globes, which protect the lamp, spread the light and improve the appearance of the pole.

Broken globes are dangerous and cause serious injuries to children, adults and animals. They also cut and ruin rubber tires. Unlighted lamps cause accidents, and encourage the activities of rowdies, thieves and burglars. Broken globes add to the expense of street lighting. To replace those broken in 1920 cost over $17,000, at least one-half of which was due to mischief and careless driving. The other half was due to breakage by the wind.

The company is doing its part to provide good globes and to fasten them securely. Drivers should be careful not to drive into lamp poles. Boys should remember that "It's not fun" to injure others, to cause accidents and to destroy property.

REMEMBER—Any street lamp or fallen wire may have a dangerously high voltage, and many persons have been killed through climbing poles and touching fallen wires. LEAVE THEM ALONE.

TEXT OF POSTER ISSUED BY THE ROCHESTER GAS & ELECTRIC CORPORATION

Important Factors in Bettering Public Relations

DISCUSSING the advances that have been made toward a better understanding of utility problems on the part of the public, John A. Britton, chairman of the public policy committee of the Pacific Coast Division of the National Electric Light Association, pointed out in the committee's report that the many consumer-ownership plans of financing had proved of inestimable worth to the utilities from a public policy point of view. The report said in part:

"It has been estimated that there is in the neighborhood of $5,500,000,000 now invested in the gas and electric utility companies in the United States and, reading the future by the past, it is estimated that the annual average growth will be about 8 per cent. This will mean an annual requirement of nearly $500,000,000 of new money in the United States in the immediate future, or considerably in excess of $5,000,000,000 in the next ten years if the present rate of growth is to be maintained. At least a goodly portion of this great sum must come from the pocketbook of the consumer through his ownership of the junior securities of the utility which serves him. There is probably no better way in which to arrest the unrest of the people and dissatisfaction, which in most cases is imaginary, with public service bodies than to have the consumers interested as stockholders and boosters in the enterprise. The attitude of the public service corporations should be not only to enlist the investment of consumers but to make it their business to see that these investing consumers are given the full facts in connection with the operations of the utility of which they are a part, so

that they may be agencies in their community to help in establishing a true relation as between the utility and the public. With that interest fully centered it is certain that much of the agitation for municipal ownership or state control would rapidly disappear."

Having in view the promotion of a better understanding of public utility questions, the committee said: "It would appear to your committee that member companies have a duty to perform which has been more or less neglected in the past, and which may be and possibly is responsible for some of the distrust still lingering in the minds of the people concerning the management and the operation and financing of public utilities, and that is the lack of proper information obtained by the young man and woman attending public schools and universities. It would seem as if colleges commonly used as a method of exploitation for certain subjects should be used by utilities in insuring the appearance of men trained in the affairs of public utilities before at least the high schools and universities of this country in proper explanation of the present status of public utilities and their aims and ambitions, to counteract the mistaken ideas of past errors still existing in the minds of the teachers, who cannot reasonably be expected in the multitude of their duties to be thoroughly informed on the subject of utility regulation and finance. There is no more fertile field for the dissemination of true knowledge of the business of public utilities than the medium afforded by high schools and universities. The error exists commonly in public utility affairs of telling the story to those cognizant of the facts and leaving the uninformed masses ignorant of the truth in connection with this great industry."

The day of profiteering in public utilities, the committee pointed out, has gone down into the dim and distant past, and among all the industries of this country today there is not in existence one that serves the public with less margin of profit than does the public utility. It is virtually doing business on an economical cost basis, earning only sufficient to pay the interest on the money which it must borrow to develop and carry on its work of service and lay a sufficient margin aside to care for the depreciation on its property. The committee felt that the past year had been one of understanding and that the realization will come to the mass of the people within a brief period that the utility which serves them is as much an integral part of the state as is any merchant or manufacturer, and that an industry which helps in developing the state's industries and without which the state could not prosper is entitled to a fair hearing before the court of public opinion.

Employees of Illinois Utility Sell Entire Note Issue in One Week

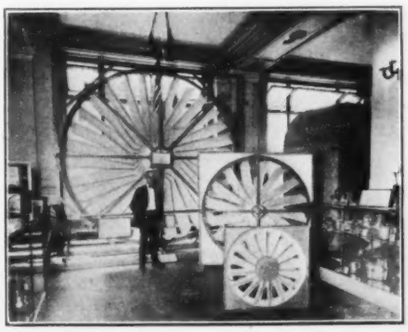
WITH the employees acting as salesmen, an entire issue of $233,000 of bond secured gold notes of the Danville, Champaign & Decatur (Ill.) Railway & Light Company was sold to the public and employees within one week. Commenting on the success of the campaign, F. W. Bedard, general superintendent of the company's property at Champaign, said:

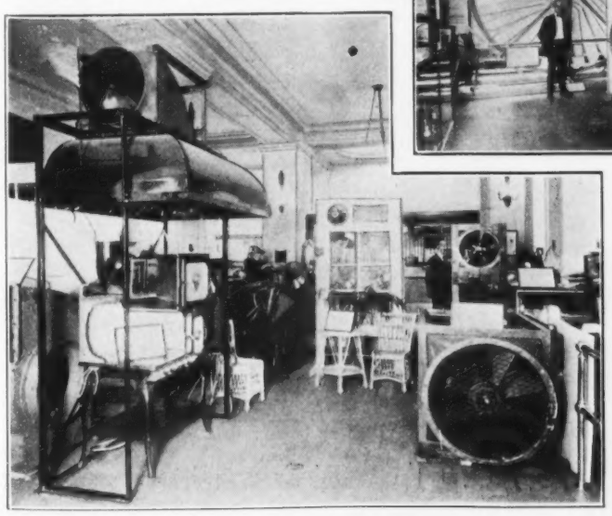
"Up to the present time virtually all funds for developing our properties have been secured from outside investors by selling the entire issue to a broker to be resold to his clients. Our recent plan of offering customers and employees an opportunity to buy this security, which was an especially attractive one for the investor, was in the nature of an experiment.

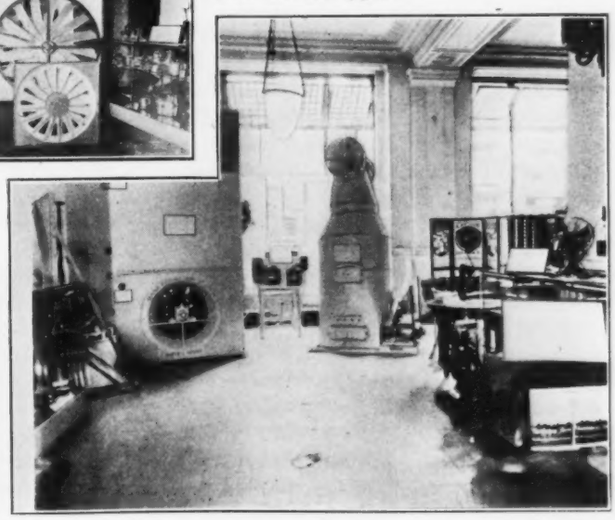
"It is necessary for a utility company operating in growing communities of this size to spend from $100,000 to $400,000 each year in normal times in extensions and improvements in order to keep pace with the city. In the future it will be the policy of our company to offer residents and customers in these communities securities it would be required to sell in order to make these extensions."

New York Has Successful Electric Ventilating Show

ELECTRIC ventilation as applied to factories, stores, theaters, restraurants, homes and other places was the subject of a successful show extending over a week and a half from June 20 to June 29 in the showrooms of the New York Edison Company. This was in accordance with the free monthly special show program of the company. The show came during the hottest days of the summer and, advertised as the coolest place in town, attracted unusual attention. The illustrations are typical of the exhibits. In the oval is shown a 12-ft. Typhoon fan, a record size for its type.







Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Relationship Between Efficiency and Working Costs of Small Motors and Generators.—E. G. KENNARD.—The writer points out that there is a greater difference in the efficiency of motors and generators rated alike than is generally recognized. On account of the increasing cost of electrical energy this has become a more important matter than formerly, and he undertakes to show how to balance a difference in efficiency against the difference in first cost.—London *Electrical Review*, June 17, 1921.

Welding a Hydro-Electric Generator Shaft.—A description of the famous welding of a broken hydro-electric generator shaft. The diameter of the shaft is 5 in. (12.7 cm.).—*Power*, July 12, 1921.

Lamps and Lighting

Luminescence of Certain Oxides Sublimed in the Electric Arc.—E. L. NICHOLS and D. T. WILBER.—Oxides prepared by sublimation are found to respond to excitation by cathode rays, as well as to flame excitation through a wide range of temperatures. The temperature at which excitation ceases is in general the same, taking each band separately for flame excitation and for cathode excitation. The shift in the color of luminescence is in general toward the violet with rising temperature. The influence of pressure on luminescence is also discussed.—*Physical Review*, June, 1921.

Recent Developments of the Quartz-Tube Mercury Lamp.—M. LEBLANC.—The author mentions the different problems which occur in the construction of the quartz-tube inclosed mercury arc, describing the improvements made since 1914. The article is well illustrated and contains details on leading-in wires, gas-filled lamps, additional heating coils, metal anodes, equilibrium of the mercury between the electrodes, cooling methods, and alternating-current lamps.—*Bulletin de la Société Française des Electriciens*, Vol. I, No. 2 (1921), page 89.

Generation, Transmission and Distribution

Difficulties of the Smaller Electricity Supply Companies.—A. N. RYE.—The problems of the small utilities in England are set forth to show that with rising expenses and with revenues restricted by legislation these companies have not had sufficient profit to warrant any increase in capital expenditure, greatly to the detriment of the industries.—London *Electrician*, June 24, 1921.

Industrial Plant Substations.—E. G. MERRICK and B. NIKIFOROFF.—Several simplified one-line diagrams of substations are included in this article, and a brief analysis is given of each in order to illustrate more clearly the considerations governing the selection of different types of stations to meet various conditions.—*General Electric Review*, June, 1921.

A Country Hydro-Electric Installation.—The description of a small installation in which the pipe line is about 2,000 ft. (600 m.) long operating under a head of 287 ft. (87 m.). The generating units consist of a waterwheel generator rated at 22 kw. and operating at 650 r.p.m. A concrete dam 6 ft. (2 m.) high with about 9 ft. (3 m.) spillway and 6 in. thick, is used.—London *Electrical Review*, May 27, 1921.

Electric Vehicles from the Power Station Engineer's Viewpoint.—RAYMOND J. MITCHELL.—The writer believes that central-station managements in England are losing an opportunity to push electric vehicle service as an off-peak load.—London *Electrician*, June 24, 1921.

Ash Disposal in Large Boiler Houses.—R. SCHOLTES.—An interesting article containing details about different methods of ash disposal and their operating cost per ton of ashes. It was found from answers to a circular letter sent out to a number of steam power plants that there is a large variation of the cost of the disposal of ashes in the different plants, from a minimum of 6.38 to a maximum of 43.02 marks per ton. Employing hand power, a man can handle about 3 tons of ashes per day, and at present wages receives 42 marks a day, so that an amount of 14 marks per ton would be normal. During the war a large number of prisoners were used for ash handling in many German power plants. A tabulation is given comparing pneumatic, conveyor and hand systems:

System	Pneumatic	Conveyer	Hand
Cost per ton	34.0	13.20	17.50 mk
One man per day	5 tons	7.5 tons	2.6 tons

—*Elektrische Kraftbetriebe und Bahnen*, June 10, 1921.

The Electric Melting Furnace as a Central-Station Load.—H. A. WINNE.—The author points out the importance of electric furnace loads both for steel making and brass melting, giving the accompanying table on the development of the electric steel furnace industry:

TOTAL CAPACITY AND POWER CONSUMPTION OF ELECTRIC STEEL FURNACES

Year	Estimated Total Installed Kva. Capacity	Estimated Total Annual Kw.-Hr. Power Consumption
1911	5,000	22,000,000
1915	25,000	45,000,000
1917	100,000	155,000,000
1919	240,000	260,000,000
1921	320,000	.....

He discusses the matter of power factor to show that the electric furnace is not an undesirable central-station load. Both arc and induction furnaces are considered.—*General Electric Review*, June, 1921.

Ground Protection.—A. ROTH.—The author compiles the many different methods used today for ground protection and criticises their properties and reliability. The article considers: (1) Compensation of the ground current; (2) Y-point grounding; (3) horn gap with resistance; (4) cylinder gap with resistance; (5) aluminum cells; (6) lead superoxide cells; (7) Nicholson arc quencher. A great number of tests on actual lines,

to study the size and length of the arc formed and to analyze each case, conclude the article.—*Elektrotechnische Zeitschrift*, June 23, 1921.

The Dalmarnock Power Station.—A continuation of the article appearing in the May 27 issue, in which further details of the 15,000-kw. generator as installed in this plant are given.—London *Engineering*, June, 10, 1921.

Traction

Standardizing of Output of Motors for Street Railways, Branch Line Roads and Main Roads.—A WICHERT.—This is an attempt at economical motor standardization on a scientific basis. For all trolley lines, suburban roads, subway and city surface lines, which are operated by direct current, motors should be designed in steps of the cube root of two, that is at about a 25 per cent increase from step to step, and it is assumed that with ten types all requirements could be covered up to 1,000 hp. For alternating-current main roads steps according to the square root of two, or about 41 per cent increase between motor sizes, are suggested. For speeds within 45 km. to 125 km. per hour and locomotive types with two to six driving axles of a total of from 580 hp. to 2,320 hp. only two types of motors would be sufficient.—*Elektrotechnische Zeitschrift*, June 23, 1921.

Pioneer Trackless Trolley Installation.—It is said that the trackless trolley bus has been put in operation in conjunction with rail service in the city of Richmond. Tests are being conducted to demonstrate its worth and flexibility in comparison with cars running on tracks. Details of construction are given which show this bus to be comparable to the one-man safety car. The double trolley overhead construction is also described.—*Electric Railway Journal*, June 25, 1921.

Fundamentals of Rational Electrification.—GEORGE R. HENDERSON.—An example is worked out to show what factors should govern the adoption of electric operation on heavy grades.—*Railway Electrical Engineer*, June, 1921.

Installations, Systems and Appliances

Electric Driving in the Paper Mill on Heat Economy Lines. — A. B. MALLINSON. — In paper manufacture steam is said to be a necessity for several processes. It is shown how steam otherwise wasted can be used for electric generation. Various types of power houses are discussed for the utilization of this surplus steam.—London *Electrician*, June 17, 1921.

Electric Drive for Small Automatic Self-Dumping Skip Hoists.—R. H. MCLAIN and C. B. CONNELY.—The authors discuss three general classes of self-dumping skip hoists with the idea of showing their usefulness and also their limitations. They express the opinion that the field of usefulness of these skip hoists could be considerably extended by a careful study.—*General Electric Review*, June, 1921.

Ground Choke Coils as a Protection Against Ground Current and Overvoltages.—R. BAUCH.—A long theoretical treatise dealing with the action of a grounding choke coil. Without the use of such a coil a voltage of about four times the normal value has to pass through one phase of a three-phase transformer in case of a ground on one phase, which will in most cases cause a puncture. Connecting a grounding choke coil to the Y-point of the transformer will prevent the reflection back through the transformer with increased potential, of a line disturbance caused by a ground on the line, but will annihilate this oncoming energy and pass it to ground. It is necessary, however, to have all this energy pass through the winding of the transformer. Its coils will not stand this stress if the overvoltage disturbance is backed by a large amount of energy. The grounding choke coil is therefore not suited for the safe annihilation of traveling waves. By means of theoretical calculations the author finds that it is much better to employ on a three-phase line three-pole grounding coils instead of one Y-point choke coil. Such a pole ground should consist of a three-phase transformer with a fourth magnetic return, *i.e.*, a four-legged core. Its primary is star-connected with grounded neutral; the secondary is an open delta, closed over a special regulating iron-core reactance. The author describes in detail laboratory experiments, made with such "quenching transformers," using the oscillograph extensively to investigate its operation. Finally the actual construction of these transformers and their proper connection is given. — *Elektrotechnische Zeitschrift*, June 2 and 9, 1921.

Electric Pumping.—L. F. ADAMS and R. A. JONES.—A comparison between pumping by electricity, gas engines and steam engines, showing the economy of the electric drive for this purpose.—*General Electric Review*, June, 1921.

Telegraphy, Telephony and Signals

Radio Telephony: A Survey.—R. L. SMITH-ROSE.—This is the first of a series of articles on the development of radio telephony. In this number the author discusses problems and principles in a general way and also the Duddell-Poulsen arc.—*Beama* (British Electrical and Allied Manufacturers' Association), June, 1921.

Automatic Telephone Systems.—M. GUTTZEIT.—The installation of automatic telephones offers great technical and economical advantages. The system of Stowger-Siemens and the Western Electric apparatus are described. In spite of the high development of these systems, they are not fully worked out as yet, the final tendencies being toward the cheapening of the equipment. The self-connecting telephone is excellently suited for private exchanges, even those of smallest extent. It may also be used to advantage for the betterment of manually operated exchanges. The paper is well illustrated.—*Vereines Deutscher Ingenieure*, June 11, 1921.

Miscellaneous

The English Electrical Industry.—E. ROSENBERG.—The following points of decisive importance are considered: (1) Free trade, whereby the English industry remained unprotected from foreign competition, while it was not dependent on English suppliers alone for raw material; (2) the strength of the trade unions, which everywhere hampered free development; (3) the large number of manufacturers, mostly small or of moderate size only, carrying on unlimited competition with one another; (4) owing to the severe competition between firms, the position of the buyer, and particularly that of the buyer's technical expert, became all-powerful. The writer deplores the severe guarantee conditions which, as an outgrowth of these conditions, have been imposed by consulting engineers.—London *Electrician*, June 3, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

President of American Engineering Council to Be Elected Next Month

ELECTION of a president in succession to Secretary of Commerce Hoover will be the most important business before the American Engineering Council of the Federated American Engineering Societies when it meets in the Cosmos Club at Washington on Sept. 30 with Vice-chairman Calvert Townley in the chair. Nominations for the presidency were ordered at the last meeting of the executive board to be reported at the September meeting.

It is probable that the board will decide at this meeting whether to hold future meetings regularly at its headquarters in Washington or to continue to meet at various engineering centers as in the past year. Other matters that will come up for consideration are plans for the engineering assembly, extension of employment service and the question of licensing and registration of engineers. A. P. Davis is chairman of the engineering assembly committee, the other members being Philip N. Moore, L. P. Alford, John C. Hoyt and F. A. Vaughn. Present plans are to make this assembly a three-day meeting in January. One day will be given to special meetings of the executive boards of member organizations and committees of the A. E. C.; one day will be given to the sessions of the A. E. C., and at least one day will be given to the discussion of some special topic such as elimination of waste, licensing and engineers, the national department of public works or some other subject of equal importance to the engineering profession.

On the question of licensing of engineers it is contemplated that the council's licensing committee will be able to submit a complete report to the board as a result of hearings to be held before the committee on this subject.

New Orleans Utility Held Not Justified in Refusing New Service

HOLDING that the light and power supply of New Orleans is in a precarious condition, the committee appointed by the Commission Council of that city to investigate the stations of the New Orleans Railway & Light Company has none the less reported that the company, which is in the hands of a receiver, had no justification for refusing to take on additional small consumers in the districts now served or contiguous areas. The committee, of which City Engineer Klorer and City Electrician Cullinan are members, made recommendations looking to the speedy rehabilitation of the company's plant and the installation of new equipment to keep pace with the city's needs. It declares that in order to have the situation in hand by the winter of 1922-1923 it is essential that two 10,000-kw. alternating-current generators and nearly equivalent boiler capacity should be supplied. It suggests that if no other means of raising funds can be found receivers' certificates to cover the cost of this equipment shall be issued.

Commissioner of Public Utilities Maloney announced that he and the utility expert employed by the city would take up immediately with the railroad officials, Receiver O'Keefe and General Manager Kempster, the matter of the company's refusal to take on small consumers of light and power.

Service-Running Contests Popular

SERVICE-RUNNING contests like the one put on at the Drake Hotel during the Chicago convention of the National Electric Light Association are rapidly becoming a feature of central-station employees' outing picnics. One was held at the Edison picnic in Chicago on June 18 in which a crew each from Chicago and Milwaukee participated, the Milwaukee crew winning. At the annual picnic of the employees of the Milwaukee Electric Railway & Light Company on July 27 the same crews participated in a contest which was won by Chicago. The elapsed time for the Chicago and Milwaukee crews respectively in the latter contest was nine minutes and fifty-nine seconds and ten minutes and forty-seven seconds, with corrected time for penalties of ten minutes and thirty-four seconds and twelve minutes and twenty-two seconds. The corrected time in the former contest was 14:32.2 for Milwaukee and 15:07.5 for Chicago. The total penalties assessed in the former contest were 205 seconds, of which 135 were for the violation of safety rules. Penalties for accidental dropping of tools and materials are not counted as violations of safety rules. The reduced time at Milwaukee is due partly to a reduction in amount of work done but also to much better and cleaner work on the part of the crews.

The employees of the Cleveland Electric Illuminating Company recently staged a contest of this kind and a number of other Middle Western companies are also holding contests within their own ranks. The Chicago-Milwaukee contests are the first ones between the employees of different companies. They have excited a great deal of attention and are becoming the subject of inquiries from all over the country.

Seattle to Continue Work on Skagit Development

ADDITIONAL bonds in the amount of $5,500,000 have been voted by the City Council of Seattle to continue the development of power on the Skagit River. Several million dollars have already been spent in preliminary work on this project, which is situated more than 100 miles north of the city. The plans call for an initial installation of 30,000 kw. in two generating units, a tunnel, a crib dam and a single-circuit, 165,000-

volt transmission line to the city. Later it is planned to build a permanent concrete dam and raise the head so that 60,000 kw. may be obtained from the original units by changing the runners on the turbines. The third step in the development of the plant will probably be the addition of a third unit of 30,000 kw. rating, bringing the station to its ultimate capacity of 90,000 kw. It is not expected that the station will be in operation before two or three years.

S. Z. Mitchell Again Heads N. E. L. A. Public Policy Committee

PRESIDENT BUMP of the National Electric Light Association announced this week the acceptances of the following national committee chairmen:

Public policy committee—S. Z. Mitchell, president Electric Bond & Share Company, New York (re-appointed).

Customer ownership committee—John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago (new committee).

Rural lines extension committee—G. C. Neff, general superintendent Wisconsin Power, Light & Heat Company, Madison, Wis. (new committee).

Rate research committee—Alex Dow, president Detroit Edison Company (reappointed).

Southern California and Cleveland Companies Issue New Bonds

SIX million dollars in general and refunding mortgage 6 per cent gold bonds of the Southern California Edison Company have been placed on the market at 88, to yield 7.07 per cent. These bonds are due Feb. 1, 1944, and are redeemable at 105 and interest on any interest-payment date up to and including Feb. 1, 1942, and at 102 and interest on any interest-payment date thereafter.

The Cleveland Electric Illuminating Company announces an issue on Aug. 1 of $5,000,000 twenty-year 7 per cent sinking-fund gold-debenture bonds at 95 and interest, to net about 7½ per cent. A sinking fund of 2½ per cent per annum of the total amount of debenture bonds issued is provided for their purchase in the market, if obtainable, up to 100 and interest.

Lackawanna Railroad Electrification Bids Rejected

ALL BIDS for supplying electrical equipment for the proposed electrification of some of the mileage of the Delaware, Lackawanna & Western Railroad have been rejected. Although the extent of the electrification has not been definitely decided, the initial installation would be that part of the Lackawanna system running through the anthracite coal region of which Scranton, Pa., is the center.

Friday, July 29, was the last day upon which bids could be submitted. All were found unsatisfactory. Gibbs & Hill, consulting engineers for the Lakawanna, received the bids, and it is understood that new offers probably will be advertised for in the near future. The General Electric Company and Westinghouse Electric & Manufacturing Company were the only companies that submitted bids for furnishing the heavier equipment.

D. H. Braymer Becomes Co-Editor of the "Electrical World"

WITH this issue Daniel H. Braymer, who since April, 1919, has been managing editor of the ELECTRICAL WORLD in charge of production and with supervision over the engineering phases of the paper, becomes co-editor with William H. Onken, Jr. By this appointment Mr. Onken is enabled to engage more fully in the study of national problems of economic importance to the electrical industry in addition to keeping actively in touch with the guiding forces of the national associations in the field.

Mr. Onken joined the editorial staff of the *American Electrician* in 1900, and in 1906, when it was absorbed by the ELECTRICAL WORLD, he became managing editor of the latter and ten years subsequently was made its editor.

Mr. Braymer first came on the ELECTRICAL WORLD staff in 1915 as engineering editor. Two years later he resigned to become editor of the *Electrical Record*. In

W. H. ONKEN, JR.

D. H. BRAYMER

1919 he returned to the ELECTRICAL WORLD as managing editor. Mr. Braymer was born in Hebron, N. Y., in 1884 and was graduated with the degrees of A. B. and E. E. from Cornell in 1906. His first occupation after graduation was with the Electrical Testing Laboratories, New York City, in special work on alternating-current apparatus. He resigned to become factory inspector in the service and maintenance engineering department of the Western Electric Company at New York, later becoming special engineer for that company. Since 1910 he has devoted himself to editorial work in the electrical field. He was editor of *Electrical Engineering*, formerly the *Southern Electrician*, until 1915, when, as stated before, he joined the ELECTRICAL WORLD staff. He is author of "Armature Winding and Motor Repair" and joint author with W. T. Taylor of "American Hydro-Electric Practice."

Oklahoma to Adopt Construction Rules

TENTATIVE printed construction rules have been issued for discussion by the Corporation Commission of Oklahoma. These cover overhead crossings, conflicts and inductive interference. The inductive interference rules follow the form of the California rules. Hearings were originally set for August but have been postponed to Sept. 13, when a public hearing will be held.

Crocker-Wheeler-Curtis Association Lasted Over Half a Century

IN PRESENTING in the issue of July 16 the appreciation by Dr. S. S. Wheeler of the accomplishments of the late Prof. F. B. Crocker it was erroneously stated that Professor Crocker, Dr. Wheeler and Charles G. Curtis had been "in almost constant contact about technical matters for forty years." The facts are that all three had been brought together as boys because of their great liking for technical studies. Young Wheeler was making a collection of chemicals and Crocker was introduced to him as a person from whom he could get certain chemicals that he had been unable to obtain anywhere else. Curtis was attracted to Wheeler because of certain mechanical devices the latter had made in school. Thus, as a matter of fact, it was more than fifty years ago when, as boys of about ten years, these men began their association from which so much of value to mankind was to result.

Cincinnati Gas & Electric to Increase Its Generating Capacity

BY THE flotation of $6,000,000 in gold notes, to which issue reference has already been made in the ELECTRICAL WORLD, the Cincinnati Gas & Electric Company has been enabled to enter upon a program of expansion and improvement of which the chief feature will be the installation of a fourth generating unit in its power house, bringing the total normal rating of the station to 100,000 kw., or 120,000 kw. under pressure. Other improvements scheduled are substations, transmission lines and extensions to the electric and gas properties.

The great growth of the electrical business of the company is shown in the figures for the years 1915 and 1920. In 1915 the peak of the company's electric load was 22,500 kw., while in 1920 it exceeded 70,000 kw. The three present turbine units have a normal capacity of 75,000 kw. Under a twenty-year contract recently made the company will supply the street-railway system with one-half of its electric power. This will be made possible about the first of September, when the fourth unit will be in operation.

The report recently distributed to the stockholders shows that the number of electrical consumers has increased by leaps and bounds under the presidency of W. W. Freeman. On Jan. 1, 1916, their total number was 23,663; at present they number more than 56,000.

Definite Steps Taken to Develop Electrified Furniture

JOSEPH F. BECKER, sales manager United Electric Light & Power Company, New York City, gave an interesting talk before the executive committee of the Commercial Section, N. E. L. A., at the Association Island meeting, on the subject of electrified furniture. The United company has appropriated $2,000 for the purchase and equipment of a complete set of residence furniture, as a practical demonstration of the benefits that will be derived from the installation of additional convenience outlets in the furniture itself, and Mr. Becker is devoting much time and attention to the development of this new idea.

The innovation comes as the outgrowth of a series of conferences which Mr. Becker has had with the New York Furniture Exchange, several furniture manufacturers and a number of large department stores. He reported the furniture people as enthusiastic over the idea and confident that it will have strong popular appeal. As the first step the United company proposes to produce an assortment of electrified furniture and place it on exhibition this fall at the New York Electric Show, the New York Furniture Show, in the furniture department of the John Wanamaker department store in New York, at the company's own salesroom and finally at the N. E. L. A. convention next summer.

Mr. Becker exhibited models of furniture and explained in general the plans for equipping the different pieces with convenience outlets. The matter of wiring methods, he said, has already been taken up with the Underwriters, and it is proposed to have a set of standard specifications drawn up by the Underwriters' Laboratories in Chicago for the guidance both of the furniture manufacturers and the electrical contractors who may be called upon to install receptacles in furniture already in use. Mr. Becker asked the Commercial Section to co-operate by providing the necessary funds for the development of the standard specifications, and an appropriation of $700 was voted to defray this expense.

Federal Power Commission Issues More Licenses and Permits

THE executive secretary of the Federal Power Commission has been authorized to issue the necessary supplemental instrument changing licenses issued prior to May 28 so as to make them subject to the regulations as amended on that date. Licenses have been issued by the commission to the Rock Creek Power Company, a Montana corporation, for a 1,060-hp. development on Rock Creek, in the Missoula National Forest; to Grace S. Eyre of Buena Vista, Col., covering a 560-hp. project on Chalk River, in the Leadville National Forest; to the Wisconsin-Minnesota Light & Power Company for a development on the Chippewa River, in Sawyer County, Wis., and to the Idaho Power Company covering a transmission line on the Fort Hall Indian Reservation designed to permit an exchange of power between the systems of the Idaho Power Company and the Utah Light & Power Company.

Preliminary permits have been issued to Reed A. Bingham for a 4,500-hp. project on the Perdido, Styx and Blackwater rivers in Alabama and Florida and to the Columbia Railway & Navigation Company for a project which involves the connection by canal of the Santee and Cooper rivers. A proposed power development by Union City, Mich., on the St. Joseph River in Branch County, Mich., has been found not to come under the jurisdiction of the Federal Power Commission because the river at that point is not navigable and the development does not affect interstate or foreign commerce.

Construction Rules Contemplated in Georgia

A BILL now before the Legislature authorizes the Railroad Commission of Georgia to establish overhead construction rules. Overhead crossings, conflicts and inductive interference are included in the bill in its present state. It is understood that the bill requires the adoption of rules within ninety days after the law becomes effective.

Chicopee to Buy Electricity for Fifteen Years More

A FIFTEEN-YEAR contract between the city of Chicopee, Mass., and the Turners Falls (Mass.) Power & Electric Company went into effect Aug. 1. The city has been purchasing electricity from the company for the last five years, and the new base rate represents an increase of slightly under 5 mills per kilowatt-hour. The municipal lighting department notified the city Water Department that its rates for electric pumping would be correspondingly increased.

The base rate in the new contract is 1.65 cents per kilowatt-hour. A coal clause is also embodied, with an added rate of 1.25 mills per dollar increase per gross ton in the average cost of coal stored at the company's Hampden steam plant above an eight-dollar base. If on the first of any month the cost of coal exceeds $8 at that point, the additional charge is computed as follows: The total kilowatt-hours taken by the city during the month is divided by the total permanent power billed to all customers of the company during that period, and the quotient is multiplied by the total number of kilowatt-hours generated by steam which is generated or purchased by the company during that month to supply its permanent load. This product equals the number of kilowatt-hours taking the added rate.

Unusual Activity in Inductive Interference Situation

UNUSUAL activity appears to characterize the inductive interference situation, particularly in the adoption of rules. The Ohio Legislature passed a law, effective Aug. 3, requiring the adoption of overhead construction rules, including regulations on inductive interference, within six months. The Georgia Legislature has a similar bill before it now. The Oklahoma Corporation Commission has issued tentative rules and set hearings for September.

In Illinois the Homer case was no sooner disposed of than the Lena case, involving the desirability of ground-return telephone circuits, came before the commission and attracted attention from both the telephone and the power interests. A similar case came before court at Worthington, Minn., two weeks ago, but was settled by a temporary agreement.

The chief engineer of a Middle Western commission who cannot be quoted told a representative of the ELECTRICAL WORLD that there was unusual activity in this matter in his state, no less than four cases requiring his immediate attention, though they had not as yet reached the stage of public hearings.

Agitation was started this spring in Wisconsin by a suggestion of an independent telephone representative to the Wisconsin Electrical Association for the appointment of an inductive interference joint committee. As yet the move has made no particular progress.

In addition to these moves that have become public there have been several cases in various parts of the country not made public in which temporary settlements have been made between the interests affected.

Heavy Light and Power Financing in July

THE demand for all high-grade investment issues has been extremely active because of the decided relaxation in monetary conditions. Accordingly the volume of investments offered by the electric light and power utilities during July was of large proportions. The twenty bond and note issues of the month, as listed in the table below, totaled $50,697,315, yielding on an average 7.51 per cent. Since the beginning of the year electric utility investment offerings aggregated $247,358,143. This figure, denoting an increase of about $50,000,000 over the corresponding total for the first seven months of 1920, is further evidence of the upward trend in utility financing.

This month's flotation is twice as large as that of July of last year, exceeds that of last month by over $30,000,000 and falls short of equaling the record set in May by only $5,000,000. Longer terms, larger single issues and lower rates of interest are the chief features to be noted. All but two of the issues are for a period of from fifteen to thirty years, and seven of them exceed $3,000,000 each. The decline in the past few months in the rate of return has been considerable and constant. In April the average yield was 7.78 per cent; this month it was 7.51 per cent.

The $7,000,000 issue by the Rochester Gas & Electric Corporation of twenty-five-year general mortgage gold bonds, selling at 96 to yield 7.35, constitutes the largest single offering.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Rochester Gas & Electric Corp.	$7,000,000	25-yr.	General mortgage series B gold bonds	Refunding and extensions	7	7.35	96
Cincinnati Gas & Electric Co.	6,000,000	1 yr. 5 mo.	Convertible gold notes secured	Refunding and extensions	8	8.20	99.75
Commonwealth Edison Co.	6,000,000	22-yr.	First mortgage gold bonds	Reimburse capital expenditures for new construction	6	6.75	91.5
Detroit Edison Co.	5,569,000	25-yr.	First and refunding mortgage bonds, series B of 1915	New construction	6	7.15	88
Cleveland Electric & Illuminating Co.	5,000,000	20-yr.	Sinking fund gold debentures	Additions to equipment	7	7.50	95
Detroit United Ry.	4,000,000	1-yr. & 20-yr.	First mortgage collateral sinking fund gold bonds	Refunding	8	8.50 & 8.10	99.5 & 99
Central Maine Power Co.	3,000,000	20-yr.	First and general mortgage bonds, series A	Refunding	7	7.45	95.5
Milwaukee Electric Ry. & Light Co.	3,000,000	.....	Cumulative preferred stock	.....	8	8.00	100
Brooklyn Edison Co.	3,000,000	20-yr.	General mortgage series D gold bonds	Additions and extensions	7	7.15	98.5
New England Power Co.	1,250,000	.....	Cumulative preferred stock	.....		8.50 until 1931; 6.00 thereafter	
Shawinigan Water & Power Co.	1,875,000	29-yr.	First refunding mortgage sinking fund gold bonds	Floating debt and new construction	6	6.75	90.5
Adirondack Power & Light Corp.	1,000,000	30-yr.	First and refunding mortgage gold bonds	Additions and extensions	6	7.25	85
Iowa Ry. & Light Co.	1,000,000	20-yr.	First and refunding mortgage gold bonds of 1912	.....	8	8	100
Fitchburg Gas & Electric Co.	678,865	.....	Stock	Cancellation of obligations and additions	...	...	55
New Bedford Gas & Edison Light Co.	572,000	17-yr.	First mortgage gold bonds, series C	.....	6.5	6.05	104.65
Potomac Light & Power Co.	550,000	1-yr.	Prior lien collateral trust notes	.....	8	8	100
Chicago, North Shore & Milwaukee Electric Railroad	500,000	15-yr.	Secured sinking fund gold notes, series B	Retirement of outstanding notes and additions	7	8.25	89.5
Central Arizona Light & Power Co.	500,000	15-yr.	First and refunding mortgage gold bonds, series A	Refunding	8	8.10	99
Athens Railway & Electric Co.	179,000	15-yr.	General mortgage and collateral trust bonds, series A	.....	8	8.20	98
Nassau Light & Power Co.	23,450	.....	Stock	.....	...	....	100
Total	$50,697,315						

Pacific Gas & Electric May Purchase Output of Hetch Hetchy Project

AN OFFER has been made by the Pacific Gas & Electric Comany through John A. Britton, vice-president and general manager, to purchase the entire output of electrical energy that will become available at the Hetch Hetchy water and power development of the city of San Francisco when this plant begins operating, which will not, however, be for two or three years. It has been reported that the city engineer, J. J. O'Shaugnessy, will recommend a wholesale disposition of all the power developed by the city as part of the Hetch Hetchy project, rather than the erection of a 150-mile transmission line into the city and an effort to dispose of the energy at retail in competition with the local companies. It is asserted that the city will have 66,000 hp. for sale when its first generating unit is completed.

Officials of the Pacific Gas & Electric Company are quoted as saying that if they can be assured of this large additional supply they can defer expensive development work for many years. The cost of labor and material is still high while rates of interest make it virtually prohibitive to undertake any but the most necessary construction at present.

United States Chamber of Commerce Formulates Taxation Program

AS A RESULT of a supplementary referendum just participated in by more than 500 business organizations the Chamber of Commerce of the United States has recommended to the ways and means committee of the House of Representatives a program of tax revision which includes a general turnover tax on all business transactions to bring in revenue which would be lost through the repeal, as also advocated, of the excess-profits taxes and the war excise taxes, both those on transportation and communication and those levied in relation to particular businesses.

Other recommendations of the Chamber of Commerce are for the decentralization of administration of income taxation, for the ascertainment by the government of any tax based on income before payment and for a court or courts of tax appeals to be entirely separate and independent of the Treasury Department. It is further proposed that net losses and inventory losses in any taxable year shall cause redetermination of taxation on the income of the previous year, that an exchange of property of a like or similar nature shall be considered merely as a replacement, that gains realized from the sale of capital assets shall be subject to lower rates than income received from business or other current activities, that income from any new issues of securities which lawfully may be made subject to federal tax shall be taxable, and that American citizens resident abroad shall be exempt from the American tax upon income derived in foreign countries and not remitted to the United States.

Repeal of War Excise Taxes Favored

A preliminary canvass of the returns received by the chamber from its member bodies shows that the most general demand, after a virtually unanimous demand in the previous referendum for repeal of the excess-profits tax, is for repeal of the taxes on freight and express charges, passenger fares and Pullman charges, and messages—that is, for an end to the war excise taxes on transportation and communication. For repeal of these excise taxes there were 1,443 votes to 290 votes against. The next largest vote was for repeal of war excise taxes levied, under the present law, in connection with particular businesses.

On the issue between an increase in the income tax for corporations and a sales tax, to take the place of the excess-profits tax, the voting was clear-cut in its indication of the point of view that prevails among the member organizations. Eleven hundred and seventy votes were cast for the sales tax to 108 for an increase in corporate income tax. On the form a sales tax should take, 1,142 votes were cast in favor of a tax on turnovers to 395 for a tax on retail sales. On the question as to which of two forms of turnover tax should be used, there were 824 votes for a tax on all turnovers to 366 for a tax on turnovers only of goods, wares and merchandise.

Electric Floodlighting a Tower of Strength in Pilgrim Pageant

ADVANCED equipment for floodlighting is a vital factor in the success of "The Pilgrim Spirit," a pageant by Prof. George P. Baker of Harvard University, which is being given at intervals this midsummer in celebration of the tercentenary of the landing of the Pilgrim Fathers at Plymouth, Mass. The pageant was viewed this week by President Harding. Thirteen hundred performers produce this spectacle by night beside the world-famous Plymouth Rock, aided by a connected lighting installation of 360 kw., which includes one of the most accurately designed installations of incandescent projectors ever achieved. Fifty "Pilgrim" type 1,000-watt floodlighting units, designed by Monroe R. Pevear of the Pevear Color Specialty Company, Boston, electrical director of the pageant, and forty-eight 1,500-watt General Electric "L-15" floodlamps are employed, with smaller gas-filled auxiliary lamps. All floodlights are operated in fixed positions, and by the use of two parabolic reflectors and an intermediate spherical reflector, forming a bell-shaped interior surface, the divergeance of rays in the "Pilgrim" units is reduced to less than 7 deg.

The wiring contractor was Charles A. Rounds of Boston, and the value of the electrical installation is about $30,000. The average height of the projector lamps is 50 ft. above the pageant field, and the total air-line distance from the supporting towers to the rear of the field is 450 ft., the width being 400 ft. Two switchboards were used in controlling the lighting service, and more than 15 miles of wire were required, with nearly 200 switches, 400 fuses and over 5,000 insulating knobs. Five incandescent searchlights are using laboratory lamps for the first practical demonstration of units requiring 100 amp. at 12 volts. The main installation is operated at 115 volts, energy being supplied by the Plymouth Electric Light Company. Nearly 10,000 persons can find seats in the stands provided for the use of spectators.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

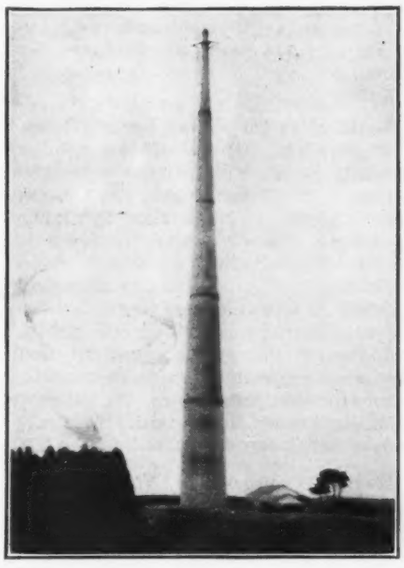
Clarksburg (W. Va.) Company Gets Increase in Rates.—As a result of valuation proceedings, the Public Service Commission of West Virginia has granted to the Clarksburg Gas & Electric Company an electric rate of 8 cents per kilowatt-hour for the first 100 kw.-hr. graded down to 2 cents for energy in excess of 5,000 kw.-hr., in order to raise an additional annual income of $30,000 to which it is declared entitled.

Flat Municipal Water-Heating Rate Proposed in Seattle.—A bill introduced into the Seattle (Wash.) City Council provides for a flat rate of $5.50 per 1,000 kw.-hr. for electricity used in household water heaters, energy consumed for this purpose being now charged for by the city at domestic lighting rates. The new rate proposed would allow the consumer to keep hot water on tap twenty hours a day for the monthly charge just stated. At present rates the same service costs $15.

Androscoggin Electric Company to Float Bonds.—A decision by the Public Utilities Commission of Maine authorizes the Androscoggin Electric Company to sell its 5 per cent mortgage bonds, dated Oct. 26, 1914, payable Oct. 1, 1934, of the aggregate par value of $415,000, at not less than 76 per cent and accrued interest, or to pledge them at not less than 70 per cent of the par value, or both, and to sell the bonds so pledged, when redeemed for the pledge, at not less than the first price. The proceeds are to be used in payment of the unfunded debt of the company and in reimbursement of its treasury for capital expenditures made since Oct. 26, 1914.

Improved Service in Easton, Pa.—In commenting on its application to the Pennsylvania state authorities for a charter of incorporation under the name Pennsylvania Edison Company, this utility, which was formerly known as the Pennsylvania Utilities Company, says: "When the present management took hold of the affairs of the company in 1917 the service to the public was almost intolerable. Many of Easton's largest industries were faced with the possibility of having to provide their own power plants. The trolley system was unable to get sufficient power to operate its cars properly, and the Board of Trade had a special committee to investigate the whole matter of power service. What has been accomplished is pretty well known. The improvement in service has been continued steadily until the service in Easton today is second to none in the country. What this has meant to the manufacturing industries in giving them an ample supply of power during their great volume of war business, and the consequent employing of large numbers of people, cannot be estimated in dollars, but it has been acknowledged by the citizens of Easton and vicinity in the spirit of fairness which they have shown by cooperating with the company during the trying times of the last four years."

High Radio Pole Made of Concrete.—There is shown here a 664-ft. concrete pole used at the 400-kva. wireless station at Havanomachi, Japan. Through this station direct communication between San Francisco and



Japan is possible. The photograph was sent to T. C. Martin by Dr. R. Mitsuda of the Imperial Electrotechnical Bureau of Tokio.

Speed of Construction on Queenston-Chippawa Power House Is Slackened.—The Hydro-Electric Power Commission of Ontario has discontinued night work in the construction of the Queenston-Chippawa power development, and the entire night shift, numbering between 3,000 and 3,500 men, has been discharged or assigned to positions on the day force. Officials state, according to the *Canadian Manufacturer*, that the work at Niagara was overmachined and overmanned, from the viewpoint of strict economy in capital expenditure per horsepower developed, but that until recently it appeared absolutely necessary to complete the work by Sept. 1, in order to deliver power for the Toronto street railway system. Now the Electrical Development Company and Toronto Power Company are being purchased by the "Hydro" system, in accordance with the agreement reached some six months ago, and as a result there will be no difficulty in supplying all the power needed in Toronto, without unduly rushing the completion of the Queenston project.

Official Emblem for Indianapolis Electric Club.—A design has been accepted as the official emblem of the Electric Club of Indianapolis, which is in the form of a large circle with the words "The Electric Club of Indianapolis" around the outer edge. A white electric light bulb is shown in the center of the circle against a solid black background. Inside the outlines of the bulb is shown a figure of "Miss Indiana" holding aloft a burning brand, symbolic of illumination. The statue forms the filament in the globe. The Electric Club was organized to further the electrical industry in the city and is composed of dealers and others interested in the trade. It has a total membership of about 150. Plans are now under way for an industrial lighting exhibition of seven different electrical systems to be held in September. Charles L. Smith of the C. L. Smith Electric Company is president of the club; Roscoe W. Mercer of the General Electric Company, first vice-president; Thomas F. Hatfield of the Hatfield Electric Company, second-vice president; George L. Skillman of the Skillman Electric Company, secretary and treasurer, and T. A. Wynne of the Indianapolis Light & Heat Company, assistant secretary and treasurer.

Associations and Societies

Rocky Mountain Division, N. E. L. A.—The second annual convention of this geographic division of the National Electric Light Association, combined with the annual convention of the Colorado Electric Light, Power and Railway Association, will be held at the Hotel Colorado, Glenwood Springs, Sept 19, 20 and 21.

Metropolitan Section, A. S. M. E.—The following executive committee has been elected for the ensuing year: Chairman, W. S. Finlay, Jr., of the American Waterworks & Electric Company; secretary, G. I. Rhodes of Ford, Bacon & Davis; treasurer, Robert B. Wolf of R. B. Wolf & Company; F. T. Chapman of American Radiator Company, and Dr. H. G. Tyler of New York University.

Coming Meetings of Electrical and Other Technical Societies

Michigan Electric Light Association — Ottawa Beach, Mich., Aug. 24-25.
N. E. L. A., New England Division—New London, Conn., Sept. 6-9.
International Association of Municipal Electricians—Colorado Springs, Col., Sept. 6-10.
Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-10.
N. E. L. A., Great Lakes Division—French Lick Springs, Sept. 14-16.
Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.
West Virginia - Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.
Illuminating Engineering Society—Rochester, N. Y., Sept. 26-30.
American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.
American Electric Railway Association — Atlantic City, N. J., Oct. 3-7.
N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 18-20.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Segregation of Operations of Dual Utility.—The fact that a public utility company is the lessee and not the owner of an electric light plant does not affect the principle that profits earned in its electrical operations have no bearing in fixing gas rates, according to a decision of the New York Public Service Commission, Second District.

Value of Service and Fair Return.—The principle that a just rate must take into account the value of the service to the public cannot destroy the principle of fair return, said the Montana Public Service Commission in fixing rates for a street-railway company, and while the service may be worth nothing to a man who cannot pay, the utility cannot be compelled to meet his necessities.

Refusal to Render Unremunerative Service Permitted.—The Public Utilities Commission of Kansas has allowed the Kansas Gas & Electric Company to refuse to extend service to ninety would-be consumers of electrical energy and ten would-be consumers of gas in Wichita, Pittsburg, Arkansas City and seven other towns, on the ground that it would require more than 165 per cent of one year's revenue to install lines.

Exaction of Twenty-four-Hour Service Unjust to Small Utility.—A small electric utility rendering less than twenty-four-hour service to 127 consumers at an income about equal to expenses cannot, the Missouri Public Service Commission asserts, justly be required to give twenty-four-hour service unless a material reduction in operating cost be effected, such as might be had through the receipt of energy from a transmission line.

Water Rights as an Element in Valuation.—In passing upon an application from the Southern Nebraska Power Company for authority to issue securities, the Nebraska State Railway Commission approved the inclusion in the valuation of an item for water rights which was determined by ascertaining the reasonable saving by use of water power as compared with any substitute which would have to be used if water power were not available and capitalizing this item at 8 per cent. Only one-half of the value of water rights was added to the valuation, on the ground that the public should benefit in part from the saving by reason of the fact that it had loaned its water power to private parties for exploitation.

Increased Rates Granted by Commission in Preference to Fuel Clause.—Opposing the adoption of a fuel rider, the Missouri Public Service Commission permitted the Campbell Electric Light & Power Company, which had experienced an increase in the cost of coal threatening to bring about operation at an annual loss of nearly $8,000, to charge increased rates designed to yield approximately $6,000 in additional revenue.

Depreciation Fund as Necessary to Municipal as to Private Plant.—Asserting that the same necessity for a depreciation fund with which to make replacements exists in the case of a municipal plant as in that of a plant privately owned, the Missouri Public Service Commission allowed the municipal plant of Independence, which had been operating at a loss, to increase its rates so as to meet operating expenses and a 4 per cent allowance for depreciation on a total valuation of $104,989.

Justification for Fixing Future Rates.—"The commission is of the opinion that it is justified in anticipating, within reason, the future," said the Oregon Public Service Commission in fixing rates for a gas company. "Under normal conditions, rates are not fixed for a day, and a continually changing schedule is unsatisfactory and expensive both to the people and the utility. Stability of rates is to be desired, and only when appreciable injustice results, either to the patrons or the utility, should rate revisions, with their attendant confusion, be permitted."

Accrued Depreciation Not Provided for Cannot Figure in Valuation.—"If, as seems to be the case," the Indiana Public Service Commission said recently, in rate proceedings concerning the Richmond Heat, Light & Power Company, "no cash has been accumulated in the depreciation reserve and the earnings have been insufficient to provide for the accumulation of a depreciation reserve, petitioner has used up its property to the amount of the depreciation in furnishing service at a loss. During the period in which most of these losses were incurred the state did not exercise its regulatory power. If the rates actually charged were insufficient, it was due to competitive conditions. The principle behind the ruling that depreciation must be deducted unless the cash is present in the depreciation reserve is substantially the same as the principle that superseded and abandoned property cannot be included in the valuation. In both cases the investment was made but the property is no longer there. . . . If the rates in effect at the time such depreciation was accruing or such property was superseded or abandoned did not yield sufficient revenue for these purposes [building up a depreciation reserve], they were unreasonably low. But this does not warrant the commission in capitalizing such deficits and adding them to the value of the property which is now used and useful."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Operation of Utility Department at a Loss Cannot Be Forced.—The Public Utilities Commission of Illinois in October, 1920, dismissed a petition of the Mount Carmel Utility & Service Company for permission to abandon its heating service, on the ground, in part, that, although the heating department was being operated at a loss, the whole business, which included electric and water departments, was being operated at a profit. The Illinois Supreme Court, in adjudicating an action brought by the company against the commission, has, however, reversed this decision and remanded the case, declaring that the state has no power to compel a corporation engaged in operating a public utility to serve the public without a reasonable compensation and that this principle extends to the operation of one branch of a business, even though its other branches may be profitable. (130 N. E. 693.)*

Tacoma Wins Victory in Condemnation Cases.—The riparian rights cases included in the condemnation suit of the city of Tacoma for lands needed in the development of the Lake Cushman power site closed in the Superior Court of Mason County with two verdicts of nominal damages of $10 each allowed the claimants. The verdicts were important victories for the city, as the claims filed had totaled $128,000. The verdicts settled the claim of the Olympia Door Company, which alleged that its timber, valued at $118,000, would be rendered valueless by reason of the reduction of the flow of waters in the Skokomish River and the impossibility of floating logs out, and the Rasmus Hanson case, involving a claim of $10,000 for other timber. The city emerged from the riparian rights cases, which included the claims of more than sixty defendants and intervenors, with a total of $41,600 of damages allowed against the municipality, more than double the amount it was estimated the settlement of all claims in the Skokomish River valley below the dam site would cost. An appeal will be taken on the legal point of whether lands which do not abut on the river have any claim to damages at all. Damages in these cases are presumably based on the factor of "fear and apprehension." The city contended that alleged fear of the breaking of the dam it intends putting in is not an element in a condemnation suit.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

W. S. Murray and **Henry Flood, Jr.**, have formed an engineering partnership under the firm name of Murray & Flood, with offices in the Grand Central Terminal, New York City. A consulting service will be furnished on general power engineering, public utility interconnections, power-plant engineering, both steam-electric and

W. S. MURRAY

hydro-electric, and heavy-traction railroad and industrial electrifications. During the past year Mr. Murray has been engaged in a very interesting economic analysis of power requirements on the Atlantic seaboard as chairman of the Superpower Survey conducted by the United States Geological Survey, and Mr. Flood has been engineer-secretary of Mr. Murray's organization. This work was brought to a successful completion on July 1 of this year, at which time the new engineering firm was organized. Mr. Murray is a well-known consulting engineer with an extensive experience, particularly in the electrification of steam railroads. In 1905 he was appointed electrical engineer and later became consulting engineer for the New York, New Haven & Hartford Railroad Company to undertake the electrification of the New York division of that road, which he completed in 1915 at a cost of $25,000,000. In 1913 he formed a partnership with E. H. McHenry, past vice-president of the New York, New Haven & Hartford Railroad Company, and completed the New Haven electrification during this association. In 1917 Mr. Murray became president of the Housatonic Power Company, which owned water-power sites on that portion of the Housatonic River within the State of Connecticut. He was also chief engineer of the Connecticut Power Company, which purchased the company owning these powers. This latter company has recently completed the hydro-electric station on the Housatonic known as "Stevenson" plant, one installation of a chain of developments which, when completed, will make Connecticut's contribution to conservation the saving of 500,000 tons of coal annually. In 1919 Mr. Murray moved his engineering offices from New Haven, Conn., to New York City and took up general consulting work on electrical generation and transmission, railroad electrification and conservation of natural resources. Mr. Murray was born at Annapolis, Md., Aug. 4, 1873, and was graduated from Lehigh University in 1895 with the degree of electrical engineer.

Henry Flood, Jr., received his technical education at Cornell University and was for a number of years associated with the electric utility industry, starting with the Newburgh Light, Heat & Power Company as assistant to the manager of the electric department, serving subsequently with the Penn Central Light & Power Company as power engineer and for seven years with the Central Hudson Gas & Electric Company as chief engineer. Following this he was mechanical engineer for the American Smelting & Refining Company, after which he took up consulting practice in New York City. His more recent work consists of an association with Dr. John Price Jackson in conducting the power survey for interconnecting the electric utility companies of western Pennsylvania, eastern Ohio and northern West Virginia and in acting as engineer-secretary for the Superpower Survey, as stated above.

Henry R. Stevens, who for the past two years has been resident construction engineer on the Kerckhoff project of the San Joaquin Light & Power Corporation, has severed his connection with that company and is making his headquarters in San Francisco, where he will devote some time to the manufacture and sale of the new fused horn-gap cut-out and disconnecting switch recently perfected by himself and Harry L. Wood. Mr. Stevens is well known on the Pacific Coast, where he has been identified with projects in Oregon, Washington and California. He designed or installed the electrical installation in the transmission station at Snoqualmie Falls, the U. S. battleship Nebraska, the Nooksack Falls station, the Bellingham steam plant, the White Salmon (Wash.) station, the Big Creek (Cal.) No. 2 station, the Lake Washington canal locks at Ballard, Wash., and many other plants on the Pacific Coast.

T. Angus, who has been manager of the Northwestern Ohio Light Company's plant at Delphos, Ohio, has been made general manager of all branches.

Harry Chamberlain, formerly local superintendent of the Pennsylvania Power & Light Company, Freeland, Pa., has been appointed superintendent of the Shamokin district, succeeding J. A. Britton, who has been advanced to the position of superintendent of distribution. Mr. Chamberlain has been in charge of the company's operations in Freeland for a number of years.

HENRY FLOOD, JR.

Percy J. Wilson, power sales engineer of the Lowell (Mass.) Electric Light Corporation, has been appointed to the position of plant superintendent. Mr. Wilson succeeds John H. Collins.

J. A. Britton, formerly superintendent of the Pennsylvania Power & Light Company, Shamokin, Pa., has been advanced to the position of assistant to the superintendent of distribution, covering the entire properties of the company. Mr. Britton went to Shamokin in 1906 as superintendent of the Shamokin & Coal Township Light & Power Company. In 1907 when that company was merged with the Shamokin Light, Heat & Power Company he remained with the new organization. In 1910 the entire property of the lighting company was sold to the Pennsylvania Lighting Company. When the control was transferred to Philadelphia two years later, Mr. Britton became general manager of the local property. In June, 1920, the Pennsylvania Lighting Company merged with others into the present corporation covering a territory extending from Stroudsburg to Williamsport. Mr. Britton is succeeded in the Shamokin district by Harry Chamberlain of the Freeland (Pa.) district.

P. H. Smith has been appointed manager of the power division of the Atlanta office of the Westinghouse Electric & Manufacturing Company.

Dr. John Ambrose Fleming, F.R.S., to whom the Albert medal of the Royal Society of Arts was awarded this year, has been closely associated for the last forty-two years with the practical and scientific developments of electricity in Great Britain. As far back as 1879 he was the scientific adviser of the Edison Telephone Company in London. In 1882 and for twelve years after he held a similar scientific position in connection with the Edison Electric Light Company of London and later on with the Edison & Swan United Company and assisted the early progress of electric lighting in London. When practical wireless telegraphy was initiated by Marconi in 1899 Dr. Fleming gave scientific assistance in its development and directed some of the early constructional work in connection with the first long-distance wireless station at Poldhu. He invented in 1904 the first form of that remarkable appliance the thermionic valve or detector, which in the later improved forms due to subsequent inventors has effected such a revolution in wireless telegraphy and telephony. This is only one of many inventions Dr. Fleming has given to this and other branches of electrotechnics. On the scientific side of electrical science he has been a prolific contributor to the transactions of various learned societies, having communicated in the last forty-eight years about ninety scientific memoirs to the proceedings of the Royal Society, the Physical Society, the Institution of Electrical Engineers and the Royal Society of Arts. About twenty of these papers described important work on the electric and magnetic properties of matter at low temperatures, carried out in conjunction with Sir James Dewar at the Royal Institution of London. He read the first paper before the Physical Society of London at its inaugural meeting in March, 1874. A paper by him on "The Necessity for a Standardizing Laboratory for Electrical Instruments," read in 1885 to the Institution of Electrical Engineers, was the means of bringing into existence the Board of Trade Electrical Laboratory and gave an impetus to the movement which later on resulted in the establishment of the National Physical Laboratory. He is the author of sixteen textbooks or treatises on electrical subjects which have had a worldwide circulation. The best known of these are his books "The Principles of Electric Wave Telegraphy and Telephony," "The Alternate-Current Transformer" and "The Thermionic Valve and Its Developments in Wireless Telegraphy," For thirty-six years Dr. Fleming has held the chair of electrical engineering in University College of the University of London. In addition to the fellowship of the Royal Society in 1892, his scientific work has been recognized by the award in 1910 of the Hughes gold medal by the Royal Society, by the institution premium (twice, in 1903 and 1912) of the Institution of Electrical Engineers, by the Bernays prize of the Society of Engineers and by a silver medal from the Royal Society of Arts. He has recently completed a book entitled "Fifty Years of Electricity, the Memories of an Electrical Engineer" (to be published by the Wireless Press, Ltd.), in which he has described the chief notable achievements of electrotechnics in the last half century, with many of which he has been intimately connected. In addition to his scientific pursuits Dr. Fleming has taken an active part in promoting popular education. The Albert medal was awarded to Thomas Edison in 1892 and to Dr. Alexander Graham Bell in 1902.

W. S. Finlay, Jr., who has been elected chairman of the Metropolitan Section of the American Society of Mechanical Engineers, is vice-president of the American Water Works & Electric Company, a position he has held since May of last year. Previous to that he was superintendent of motive power for the Interborough Rapid Transit Company, taking up the work of the late H. G. Stott. Mr. Finlay has had extensive experience in steam-plant construction and operation and has done much experimental and research work that has resulted in improved station efficiency. Mr. Finlay has been active in the affairs of the A. S. M. E. for a number of years.

W. S. FINLAY, JR.

Edwin C. Butler has taken over the electrical contracting firm of Gagen & Butler, Inc., New York City, and is continuing the business under his personal direction as president, the name having been changed to E. C. Butler Electric Corporation. Mr. Butler has had wide and varied experience in the electrical field for the past fifteen years, both in practical work and engineering. Since 1913 he has been secretary and treasurer of Gagen & Butler, Inc., and before that he was employed in an engineering or construction capacity by the General Electric Company, electric railroads, testing laboratories, consulting engineers and electrical contracting firms.

Paul McJunkin, who was instrumental in bringing a number of the independent lamp manufacturers together in the formation of the United Lamp Manufacturers' Corporation, has been a consulting engineer since 1903, engaged largely in the development of equipment and processes for the manufacture of incandescent lamps. Mr. McJunkin was born Aug. 2, 1875, in Iowa. After graduating in 1898 from the Massachusetts Institute of Technology he took up post-graduate work in physics and chemistry at the University of Chicago and under the late Prof. Rowlands at Johns Hopkins. In 1899 he became associated with the Sawyer-Man Electric Company as supervisor of technical work. His work on incandescent lamps has led him into a thorough study of tungsten and its properties. In 1906 he brought back to the United States three tungsten lamps made by the Austrian scientist, Dr. Kuzet. It has been stated that these were the first pure tungsten-filament lamps which had been seen in this country.

F. H. Hardy, the newly appointed assistant district manager of the Redlands district of the Southern California Edison Company, has been with that company since 1906 and has obtained an extensive experience in both the operating and commercial departments. Mr. Hardy was born in Fitchburg, Mass., in 1874 and moved to California in 1898. In 1902 he entered the employ of the Redlands Street Railway Company, working up to the superintendency of the Redlands division, which position he held until he resigned to join the Edison organization. He has served successively as groundman, storekeeper and troubleman in the operating department, following which he went into the commercial department of the Redlands district and has filled all positions from meter reader to chief clerk.

Lewis H. Lee has been placed in charge of the public relations department of the Georgia Railway & Power Company, Atlanta, succeeding Charles Towne. Mr. Lee is a member of the publicity organization of Ivy L. Lee of New York, and has heretofore handled the public relations department of the Pennsylvania Railroad, the American Express Company and other companies. Mr. Lee will make his headquarters in Atlanta.

Arthur S. Hall, sales engineer with the industrial division of the Westinghouse Electric & Manufacturing Company, Providence, R. I., left that organization Aug. 1 to become head of the power department of the Lewis Electrical Supply Company, 117 Federal Street, Boston, agent jobbers for the Westinghouse company.

Thomas Brady has been placed in charge of the New York office of the Green Engineering Company, East Chicago, Ind.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Collections, While Not Satisfactory, Show Improvement

TO SAY that collections are easier might be considered as putting too optimistic a face on the problem. There is, however, a decidedly less pessimistic view taken of the situation by credit men in the electrical field and the general impression gained is that they see some improvement. All along the line accounts have been closely scrutinized and credit has been extended carefully. This, of course, has had a tendency to weed out undesirable credit risks, and as a consequence collections on current billings are easier.

In some quarters it is believed that there is an undue readiness to take advantage of the existing circumstances and to delay payments unnecessarily. Such cases are not frequent, however, and where investigation shows a bona fide cause for delinquency few creditors are inclined to resort to suit. On accounts that have lapsed for a period of ninety days many firms are taking time notes, extending the payment of the balance of an account over thirty, sixty or ninety days.

Use of trade acceptances is at this time exceptional as most collections run over thirty days. Buying is, of course, on a hand-to-mouth basis for current requirements, and payment for such material is made usually within sixty days.

The worst of the situation is naturally the quantity of so-called "frozen credit." Stocks in some instances are large and have been carried now for several months with little opportunity of moving them. In other cases industrial plants have purchased and installed equipment upon which payment has not been completed. The seriousness of this problem, however, is probably exaggerated, for, as one credit man said: "After we have had just one of these accounts on our books for a while it looms up larger than all the rest of our accounts put together, while as a matter of fact it is barely 1 per cent of the outstanding unpaid accounts."

Middle West Fan Season Unusually Successful

REPORTS from all parts of the Central States indicate that the season just past has been the most successful for several years for electric fan manufacturers, jobbers and dealers. It is variously estimated that final reports on the season, available about Sept. 1, will show an increase over 1920 business of from 75 per cent to 100 per cent. Although last year proved dull on account of cool weather, the increase is still worthy of note in view of the fact that business in rural communities was small and that industrial activity is noticeable for its absence.

At this time last year many jobbers and dealers had large overstocks on their shelves and were forced to carry them over to this season. This had a noticeable effect on demand last fall when 1921 contracts were made, but the oversupply was quickly cleared out by the hot spring weather, and since that time both jobbers and manufacturers have been little more than able to keep abreast of their orders. A shortage in alternating-current types has been particularly noticeable for several weeks. The largest retailer in Chicago, with one month of the season still ahead, had sold 5,000 fans, an increase of 100 per cent over 1920 sales, and was slightly ahead of the record for 1916, the previous most successful year. Chicago jobbers estimate the increase in their sales at 75 per cent, while the Chicago branch of a fan manufacturer will show an increase of more than 100 per cent.

Much of this demand is coming from Illinois, Indiana, Michigan and Wisconsin, states which have a number of large cities. In contrast there has been a small demand from rural states, such as Iowa, Nebraska and the Dakotas. This is explained by the fact that the farmers in those sections are still holding a large part of their 1920 crops and are short of money.

All types and sizes other than the 32-volt have proved good sellers, with the 10-in. fan most popular for residence use and the 16-in. fan gaining favor for commercial purposes. Restaurants particularly have found the 16-in. fan most suitable for their purposes. Sales of the 12-in. sizes were kept down somewhat, it is thought, by a price slightly out of line. Sales of the miniature type of fan were pushed in only a few quarters, but wherever this was done orders were satisfactory.

The total value of ventilating fan sales probably does not exceed that for 1920, but the number of units sold shows an increase of 15 to 20 per cent, due to the efforts of manufacturers and jobbers to concentrate on restaurant, residence and small-plant business.

The Metal Market Situation

THE position of copper shows no improvement. In fact, the market has sagged another ¼ cent since last week. The metal is being offered by some dealers at 12 cents per pound delivered for near-by shipment. Some of the leading selling agencies are quoting nominally at 12¼ cents per pound, but it is reported that even the large interests have been making the 12-cent price when regular customers come to them with inquiries for near-by deliveries. The outside market is quoted at 12 cents for August and September deliveries. However, it is a question whether metal can be bought at this price for September deliveries from the big producers. Wire base is still quoted at 14 to 14.50 cents.

One encouraging feature is that the world's stocks of scrap brass today are probably not over 300,000 tons, whereas at the beginning of the year they were 500,000 tons in addition to the 600,000 tons of refined and blister copper carried at the beginning of the year.

Although making no official announcement of a new price schedule the United States Steel Corporation is meeting the new low prices quoted by independent producers and appears to be setting the pace in at least one product.

NEW YORK METAL MARKET PRICES

	July 26, 1921	Aug. 2, 1921
Copper	£ s d	£ s d
London, standard spot	70 0 0	70 5 0
	Cents per Pound	Cents per Pound
Prime Lake	12.50	12.00
Electrolytic	12.25	12.00—12.25
Casting	11.50	11.50
Wire base	14.00—14.50	14.00—14.50
Lead, trust price	4.40	4.40
Antimony	4.65	4.60
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.75	4.70—4.75
Tin	26.00	26.75
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.00	9.50—10.00
Brass, heavy	4.25— 4.50	4.25— 4.50
Brass, light	3.50— 3.75	3.50— 3.75
Lead, heavy	3.25— 3.37½	3.25— 3.37½
Zinc, old scrap	2.00— 2.25	2.00— 2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THERE are unmistakable signs of improvement in the electrical market. Stocks are not so large in local warehouses, and turnovers as a result are more frequent. Heavy automobile traffic and new laws have caused a very brisk market in a number of places for miniature lamps and flashlamps.

Better buying is noticed for the railroads, which is taken as a forerunner of a much greater demand from other large purchasers.

Troubled labor conditions in the building trades are preventing lower prices from bringing forth orders. Where this matter has been settled, however, there should be no occasion for holding back.

From the agricultural districts of the South the Central States and the Far West the fall is being looked forward to eagerly, as then harvest money is expected to open up the market.

NEW YORK

Some indications of slightly more active business were noticeable among the jobbers of this section during the past week. Considerable material for maintenance and repair work is moving, but orders are small, covering only the immediate needs. Contractors who have work in hand and under way are buying material only as required, and there seems to be no inclination to increase stocks. The demand for armored conductor, as reported last week, continues at about the same level and there has not been sufficient change either way to affect prices.

Another encouraging indication of more activity is the number of inquiries for materials and prices that are being received. Part of this is due to purchasing agents shopping around to obtain the best price, but there are many instances of inquiries covering large quantities of material and also heavy equipment which would be used only for new construction. Much of this business will materialize as soon as the present situation begins to clear.

Conduit.—Fairly good stocks of all sizes are the rule and prompt shipment can be made. Sales are in small quantities and are readily handled. In 2,500-ft. lots ½-in. black is quoted at $55 to $58; ¾-in., $72 to $78; 1-in., $105 to $112. On galvanized pipe, same sizes, quotations are $60 to $66, $81 to $85 and $116.96 to $123. There is virtually no change since last week, and prices are inclined to hold at these levels.

Flexible Armored Conductor.—Recent movement seems to continue, but does not increase and prices remain the same as last quoted. From $48 to $49.50 per 1,000 ft. is the current price for No. 14, two-wire single-strip.

Rubber-Covered Wire.—No. 14 single-braid in 10,000-ft. lots is quoted at $6.50 to $6.77 per 1,000 ft. Demand is only moderate and stocks are ample to large. There does not seem to be any intention of shading prices below the above quoted figures and if anything the price has stiffened somewhat.

Non-Metallic Flexible Conduit.—There is little demand for this material in the immediate territory and stocks are kept down as low as possible. In 1,000-ft. lots the following prices were quoted this week: $\frac{7}{32}$-in. size, $21, ¼-in., $23, and ⅜-in., $36 per 1,000 ft.

Fans.—With cooler weather the first of the week and the end of the fan season in sight, sales were very light. Stocks are for the most part small, but the popular sizes and types can be supplied without delay.

Heating Appliances.—Of the heating devices only irons and toasters are moving. Some jobbers report an active demand for these devices. Stocks are fair to good. The recent drop in prices on heating devices has not stimulated buying, but it is believed that this is because of ample stocks carried by retail dealers.

Outlet Boxes.—Discounts range from 45 to 55 per cent on black boxes and 40 to 50 per cent on galvanized in lots of 100. Stocks are ample, but very little is moving.

Friction Tape.—Demand for friction and rubber tape is spotty and sales are in line with other materials. A nominal quotation this week was 36 cents for friction and 43 cents for rubber in 100-lb. lots.

Metal Molding.—No change in price since the recent drop of about 5 per cent. In 1,000-ft. lots the three-wire size is quoted at $5.92 to $6.40 per 100 ft. Stocks are fair and jobbers report a moderate demand but in small lots.

CHICAGO

Though business in electrical circles during the past week has shown only slight improvement, general conditions are bettering and the tone is one of hope. It is generally conceded that railroad buying will show the way to better times, and inquiries of this sort have come into the market within the last few days for car repairs from a number of roads. While conditions are still far from good, there are signs that the slump has passed its worst stage.

Electrical jobbers and contractor-dealers have almost given up hope for any considerable construction this season as a result of the failure of Judge Landis to accomplish anything as arbitrator in the building wage controversy. Suggested modifications to the uniform agreement have been opposed by both sides. As a result jobbers' sales remain small even though prices are off in several lines. Jobbers' report collections still long, but there is nothing in the situation to cause worry. Retail trade is quiet, a most successful fan season being almost over, while other appliances sell well only when special inducements are offered.

Wire.—Bare copper wire has dropped approximately a cent per pound, No. 8 being offered at 15½c. per pound in 1,000-lb. lots. Weatherproof is down also, No. 6 triple-braid being offered at from 15½ to 16 cents per pound in large quantities. These reductions have not resulted in many orders, though there have been numerous inquiries, indicating that some line construction is being contemplated. Rubber-covered wire is quoted at $6.50 per 1,000 ft. for No. 14 single-braid.

Conduit.—There is only a fair local demand for black pipe owing to the continued lethargy of the construction market. There is a lack of stable quotations, though the nominal price per 1,000 ft. for ½-in. black conduit is $55 in 5,000-ft. lots. Flexible conduit is selling reasonably well outside of Chicago and the $\frac{7}{32}$-in. size is quoted at $24 per 1,000 ft. in 5,000-ft. lots.

Locknuts and Bushings.—In spite of curtailed construction there has been a slight increase in demand. This may possibly be accounted for by the number of rewiring jobs, both residence and industrial, that have come into the market. The ½-in. locknuts are quoted at 75 cents per 100 and at $1.10 per 100 for the ¾-in. size.

Ranges.—Considerably more electric ranges have been sold during the first seven months of 1921 by a leading Illinois utility than were sold during the same period in 1920, because of intensive sales effort. The campaign will be carried on indefinitely.

Motors.—Demand is spotty but better than thirty days ago. Orders have been received from the railroads but mainly for small sizes for shop work, and this is true of almost all orders. However, July proved better than May or June and inquiries are continuing to pick up. The 10 per cent reduction that went into effect July 12 has not affected demand much, buying being done only where necessary.

BOSTON

A better feeling is reflected in the trade, although conditions are still slow in mending. July bookings in two leading jobbers' houses hold up well in comparison with spring business. Collections are about the same, but are beginning to reflect the improved banking situation somewhat. Hand-to-mouth buying still marks jobbers' purchases, but there are indications that such orders are increasing in frequency. Inquiries are increasing somewhat. Engineering organizations are doing more report work. Prices were unsettled last week in closely competitive lines on the larger quantity purchasing. Building and engineering contracts in New England for the week ended July 26 totaled $5,000,000, compared with $6,403,000 a year ago, and were exceeded in only four corresponding weeks of the past twenty years. The metal industries in New England are quiet, operating at about one-third capacity. The paper industry is dull, with hampering labor troubles. Woolen mills are running actively, June operations having reached 75 to 95 per cent of capacity. Cotton mills average about 75 per cent of capacity, according to the Federal Reserve Bank of Boston, and the boot and shoe industry is producing at about 60 per cent of capacity.

Motors.—A slightly better tone to the market is evident from inquiries. The sale of integral horsepower motors is non-spectacular, but one prominent distributer reports sales 40 to 50 per cent as large as at this time last year and within 5 or 10 per cent of pre-war totals. Fractional-horsepower motors are very dull. Buying is very widely distributed and small-order business is dominant.

Wire.—Moderate movement is reported, with unsteady prices where large stocks are being liquidated. Rubber-covered, No. 14, sold Monday in Boston around $6.25 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—A light demand is apparent, with No. 14 double-strip selling from $50 to $51 per 1,000 ft. in 2,500-ft. lots. Stocks are plentiful for current requirements.

Lamps.—Trade is extremely brisk in 21 cp. gas-filled incandescent lamps for automobile headlight service, in view of regulatory requirements effective Aug. 15. The demand is being satisfactorily met, however. General lighting business holds up well in response to vigorous sales work on the part of central stations and retailers.

Storage Batteries.—Improved business is noted, the demand for automobile and radio cells being quite good.

Sockets.—Pull sockets are fairly active and are selling at 37.5 cents net in standard packages. Keys and keyless, at 25 and 23 cents respectively, are not moving so fast. Small orders are being placed with manufacturers, according to a representative jobber.

Ranges.—Vigorous sales effort is being rewarded by well-distributed orders, although quantity purchases are scarce. Manufacturers are well "set" for greatly increased business, and present facilities are not running at a very high "load factor."

Rubber Matting for Switchboards.—This material, although not a standard electrical jobbing product, is running very low ir stocks. Even the present light demand calls for considerable "shopping around" to fulfill.

ATLANTA

The general morale of the section is noticeably improved, particularly in the smaller towns that were very hard hit by the sharp break in the price of all agricultural products. A revival of activities is predicted in the early fall when the crops are harvested. The report of the Sixth Federal Reserve Bank shows that a larger volume of business is being done than at any time during the past year, though the money value is quite reduced. The wholesale hardware line is an exception to this rule, the volume being considerably reduced as compared with a year ago, purchases still being for small quantities for immediate delivery. The increase in building activity is reflected in the report of the Southern Pine Association for June, which shows that average orders have increased from 472,574 ft. to 518,600 ft., each week showing a healthy increase over the previous week.

Ornamental Lighting Equipment.—An unusual number of inquiries are being received for this specialty, particularly from large industrial plants maintaining mill villages. The small municipalities are also showing considerable interest. A slight decline in the price of metal posts is to be noted.

Electric Churns.—Jobbers received notice this week of a price reduction of approximately 20 per cent from manufacturers, which after being passed on to dealers stimulated sales to some extent. Activity in this line has been very weak for the past four or five months, but indications are that business will be a little better this fall.

Transformers.—A general reduction in price of 10 per cent is reported this week. Sales of distributing type are holding up fairly well owing to the demand from central stations for large numbers of new cut-ins to residences being constructed. Stocks are in very good shape. While the demand for power transformers is off considerably, there have been several good sales made in certain localities.

Armored Conductor.—Dealers appear to be buying actively from jobbers this week upon the strength of a price reduction of approximately 10 per cent. Stocks are in good shape, but it is not expected that the flurry this week will be sustained.

Commercial Lighting Fixtures.—Demand has been fairly good in the larger centers where buildings under way are being completed. Certain types have declined in price this week from 10 per cent to 15 per cent. Distributers' stocks are in excellent condition to handle the demand.

Flexible Conduit.—There has been very little demand for this item lately, the price drop of 5 per cent not affecting the situation to any extent. Stocks in this section are ample to take care of ordinary requirements.

Porcelain.—The demand for staple porcelain material is holding up very well under the circumstances, and a slight stimulation has been noted since the recent break in price. All jobbers' stocks are in good shape and prompt deliveries are being obtained from factory.

ST. LOUIS

The strike of electrical workers in the St. Louis industrial district was terminated the latter part of last week, following an agreement whereby the men will continue to receive $1.25 per hour.

The strike prevailing for the greater portion of the week greatly restricted the week's business, but the pre-strike basis now exists. Some are expecting a slight betterment of business this fall because of the effect of excellent agricultural conditions, particularly in the corn belts. In the South, too, because of crop diversity and the better movement of cotton, the situation promises to be better this fall. Credit conditions throughout the territory are improving and money is easier. Jobbers, however, still report a sixty-day collection basis.

Jobbers are actively endeavoring to increase turnover, and as a result prices are to a considerable extent competitive. Representative quotations are given here, though prices somewhat lower may be found in special cases where the size of the order warrants it.

Lamp Cord.—Prices are slightly easier, No. 18 twisted cotton selling at $13 per 1,000 ft. in 5,000-ft. lots. No. 18 twisted silk is still quoted at $23 to $25 per 1,000 ft. There is substantially no movement and stocks are inclined to be heavy.

Sockets.—Local jobbing stocks, it is claimed, are in good shape, but large stocks are in the hands of the manufacturers. Movement is very slow. Key sockets are selling at $26.40 per 100; keyless, $22.50; pull, $34.

Flexible Armored Conductor.—Owing to the electricians' strike the demand last week was quite low, but otherwise a reasonably good call exists. Stocks are now slightly heavy. Prices have recently declined, No. 14 two-conductor is now being quoted at $52.50 per 1,000 ft.

Switches.—Because of the lack of building, movement is

very limited, but better demand from the smaller localities may be found this fall. Stocks are in good shape. Flush and snap switches are quoted at $27 per 100 in standard-package lots.

Fuses.—The demand holds steady for about all kinds and sizes. Stocks vary from good to large. Plug fuses are priced at $34 per 1,000 in standard packages. N. E. C. non-renewable cartridges, 3 amp. to 30 amp., sell for 13½ cents each, and 31 amp. to 60 amp. sell for 18 cents each. Renewable fuses, 3 amp. to 30 amp., are quoted at 29 cents each, and 31 amp. to 60 amp. at 58 cents each.

Metal Molding.—Stricter municipal wiring requirements have tended to increase the demand, but because of low construction work the call for some time has been very light, particularly while the electricians' strike was on. Stocks, however, are in good shape. Wire molding is priced at $4.95 per 100 ft.

SEATTLE—PORTLAND

Although a quiet condition still persists, business locally was somewhat stimulated by the Northwest merchants' convention held in Seattle during the past week. Orders were booked by out-of-town merchants in many lines considerably in excess of expectations. The local fruit and berry crop is good and is being disposed of at satisfactory prices. Labor is cheap and plentiful. Electrical jobbers in Seattle report a moderate but fairly steady demand for fans and other seasonal goods. The high gas rates as well as the excessive cost of coal which prevails locally have been a constant stimulus to the sale of electric ranges, a fair demand for which seems to exist at all times. Bank clearings for Seattle for July 30 show a falling off of about 10 per cent over similar figures for a year ago and are slightly in excess of those for a month ago.

Manufacturers' agents in the Portland region report that the volume of business is unchanged with little prospect for improvement before fall. Jobbing business continues about the same, some reporting a little greater activity. The sale of household appliances continues active. Flat-irons are apparently leading. The reduction from $8 to $6.85 acting as a considerable incentive. The increasing number of automobiles and paved highways in this section has created a demand for flashlamps considerably greater than was expected. Stocks in all other lines, however, are in good shape, although there is no tendency toward an overstocked condition. Collections are not improved. The contractor-dealer business is in general not very active, the volume being less than it was a year ago. Cash sales are materially less than they were the first of the year, but this is considered merely a seasonal change. Small contracting work, such as residence wiring and repair work, is active. Fixture business is practically normal. Vacuum-cleaner sales are active.

The June building report for Portland shows an increase of 41.5 per cent over June, 1920. The electrical permits issued during June were the greatest in the history of the department. It is stated that this is due primarily to residence building activity and repair work.

A slight improvement in orders is reported by Spokane jobbers this week over last. Business, however, still continues quiet, with no considerable activity looked for until money from harvest gets into circulation. Lumber and mining, two of the large basic industries of this district, are inactive, with the result that dealers are focusing their hopes of better business on the excellent crops which are reported from almost everywhere throughout the district. Stocks are in good shape, deliveries prompt and collections fair. A comparatively good fall business is looked for.

Conduit.—Movement is still slow. Half-inch galvanized sells at $7.45, ¾-in. galvanized at $9.72. Corresponding figures for black are $6.98 and $9.10 per 100 ft. in carload lots

Wire.—The demand for rubber-covered is moderate. No. 14 sells at $7.20 per 1,000 ft. in lots of 5,000 ft. and less. Weatherproof is in steady demand but sales are light, No. 6 selling at $18.15 per 100 lb. in 1,000-lb. lots, while No. 8 is selling at $19.15.

SALT LAKE CITY—DENVER

The general merchandising and financial situation remains little changed in the Intermountain region. Although some profess to see distinct signs of improvement, the consensus of opinion is that business is merely marking time. However, there is little discouragement or pessimism manifest. Every one seems to believe that better times are just ahead. The feature of the week is the announcement by the Federal Reserve Bank of a lower rediscount rate, the rate falling from 6 to 5½ per cent. The demand for money continues with the usual restrictions as to loans, and country banks are still calling on the city banks for accommodation. The Anaconda Mining Company recently sold the Pacific Gas & Electric Company 10,000,000 lb. of copper wire in a single order. Three-fourths of this amount will go into the construction of a single high-tension line. A conservative estimate of the demand on the copper industry to supply the needs of electrical plants in the Intermountain and Western States during the next decade is 280,000,000 lb. It is this prospect that assures the owners of the vast porphyry plants that the present period of depression will be rather short-lived. The excess of labor supply over demand seems to have quieted pending disputes.

Miniature Lamps.—The call has been very encouraging. The reason for the augmented demand is the increased use of passenger cars. There has been no complaint of shortage of stocks.

Flashlamps.—These also have had a good run in the past two months. The extensive use of flashlamps by campers has created a seasonal demand.

Conduit.—Jobbers report stocks more than ample to meet a demand that is sluggish, to say the least. The dearth of big construction jobs is responsible for the slow movement. A 10 per cent reduction in price has not stimulated demand appreciably.

Washers.—Business thus far this summer has been characterized by few sales and small interst on the part of ultimate consumers. The high price continues a decisive barrier to better demand. Some jobbers would welcome a chance to unload excessive stocks. No recent price change has been ordered.

Cleaners.—The market is holding to a good average. Energetic dealers are reporting a splendid week to week movement. Vigorous salesmanship is required, however.

SAN FRANCISCO

During the past week the builders' strike took a turn for the worse and settlement is now apparently a long way off. At a special election the leaders who advised the strike were returned to power. The unions are now voting on calling a general strike, and it is reported that their sentiment has veered so that the majority is now in favor of such a strike.

Shipments from the East are now being made in large proportion by water via the Panama Canal at a saving of about one-fourth as compared with railroad rates. The time in transit is about three weeks longer than by rail, and the goods arrive in exceptionally good condition. The seamen's strike, it is reported, has been called off and withheld shipments can now be released.

Motors.—The recent price decrease of 10 per cent found nearly all dealers with heavy stocks on which they had to take a considerable loss. The motor business is much quieter now than during the spring irrigation season, and dealers in second-hand and repaired motors especially are experiencing quieter business than for several seasons.

Lamps.—Demand is very good considering the season, but slower sales are reported by jobbers because of their effort to cut down outstanding stocks on the dealers' shelves. A very careful survey has been made of this condition, with the result of causing an intensive campaign to provide dealers with sufficient fast-moving stock and bringing to light useless overstocks that had accumulated.

Farm Plants.—Pacific Coast stocks both in jobbers' warehouses and in those of their district dealers are very high and are moving poorly.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

National Conduit & Cable Company Not Insolvent

In the last issue of the ELECTRICAL WORLD a very regrettable error occurred in the heading of the article reading "National Conduit & Cable Company Not Solvent." The heading as written read "National Conduit & Cable Company Not Insolvent," and the change was due to a last-minute error of the typesetter which the proofreader failed to detect. The context as contained in the article itself clearly shows that the company is solvent.

The ELECTRICAL WORLD offers its sincere apologies to the company and to its receiver, Clarence G. Galston, for this error.

The receiver is authorized to continue the operations of the company and promptly took measures on July 15, the date of his appointment, to notify customers of the company accordingly.

James Magee, who has been connected with the company for the past twenty-five years, and who was formerly head of the copper department, has been made works manager.

Briefs Filed in Lamp Patent Suit

Briefs in the case of the General Electric Company versus the Alpha Laboratories were scheduled to be filed in the United States District Court on Monday of this week. This case, which is before Judge Meyer, involves both the Just and Hannaman and the Langmuir patents. Replies are to be filed by Aug. 8, and oral argument will be heard on Aug. 15 and 16.

Brown Instrument Company Opens Office in Cleveland

The Brown Instrument Company, Wayne and Roberts Avenues, Philadelphia, manufacturer of indicating and recording instruments, pyrometers and so forth, has opened a branch office in the Reliance Bank Building, 1634 Euclid Avenue, Cleveland.

Powers Electric Sales Company Adds New Line

The Powers Electric Sales Company, 1170 Broadway, New York City, has been appointed by the Liberty Machine Company, Wauwatosa, Wis., as its sales representative for the States of New York and New Jersey, as well as exporting agent for its lines of fixture fittings and castings. The Powers company also acts as representative in the same territory for the Fernando C. Mesa Company, Irvington, N. J.; the Federal Porcelain Company, Carey, Ohio; the Magic Electric Company, New York City, and the Wurdack Electric Manufacturing Company, St. Louis. Myron Kommel has joined the sales organization of the company and will serve the local trade. H. Dayton Ball is the New York State representative of the company.

Large Australian Tower Order Goes to Milliken

Milliken Brothers Manufacturing Company, Incorporated, of New York, has just secured through its London office a contract with the Electricity Commissioners at Melbourne, Australia, to furnish towers for a 112-mile, 132,000-volt transmission line in the Dominion of Victoria, Australia. The contract, which is based on furnishing 490 suspension towers, 40 strain towers, 14 terminal towers and 90 semi-anchor towers, will run in the neighborhood of $300,000.

J. E. Jennings, vice president of the company, who has been in Europe for the past six months, returned to New York last week and will sail for Australia from Vancouver, B. C. on Aug. 6 to go over the route of the line.

Sales Organization for Independent Lamps

Eleven Manufacturers Form Company to Take Over Sales and Supervise Production in Order to Secure Complete Line, Uniformly Packed and of Uniformly High Quality

Offices were opened and business started on Monday of this week by the United Lamp Manufacturers' Corporation, at 44 West Eighteenth Street, New York City. This company was formed by a number of independent lamp manufacturers as a selling, distributing, purchasing and manufacturing control organization. The purpose of the company primarily is to be able to supply a complete line of incandescent lamps in uniform packing and of uniformly high quality. This was something that none of the member companies could do alone, because none of them was so equipped. It is now planned that none of the factories will make a complete line of lamps, but each factory will be assigned to make certain parts of the complete line. In this way it is expected to obtain a high production and quality.

All lamps produced by member companies will be sent directly to the warehouse of the selling organization in New York, from which place they will be distributed to warehouses in different parts of the country to take care of local demands.

There is also being established at the central office a laboratory where all raw materials used by the manufacturing companies will be inspected and when found satisfactory sent directly to the factories.

The laboratory will also maintain lamp inspection, with inspectors in each factory. It is now planned to have visual inspection of one lamp out of every hundred and a life test given to one lamp out of every thousand. The company will not have branch offices, but all selling and billing will be done from New York and shipments made from the nearest warehouse.

It was stated at the offices of the company that a standard life and efficiency guarantee will go with the lamps. All lamps will be marketed under a trade name which has not been decided upon. There will also be a uniform packing. All sizes and types of incandescent lamps will be manufactured.

The companies were brought together largely through the efforts of Paul McJunkin, a consulting engineer who has been in the lamp industry for more than twenty years and who has been very greatly interested in developing means for bettering the quality of incandescent lamps.

The new company, which is capitalized at $75,000 all in stock, is owned by eleven contributing companies, to which stock has been apportioned in proportion to their volume of 1920 business. The total business done by these factories in 1920 amounted to $1,800,000.

Following is the list of member companies: Acme Lamp Works, Bedford Lamp Works, Bettalyte Incandescent Lamp Company. Continental Lamp Works, Daylyte Lamp Works, International Incandescent Lamp Works, Paragon Incandescent Lamp Works, Republic Electric Company, Thomas-Brown Company, Titan Miniature Lamp Company, Union Lamp Company. Others are expected to join the organization.

The officers of the company elected for the purpose of organization were: A. E. Weise, president; R. H. Herschman, secretary; T. P. Vilaghy, treasurer.

Lamp Manufacture Changes Company Name

The Electric Lamp & Products Company, 512-514 Paterson Plankroad, Jersey City, N. J., has changed its name to the Lhytan Electric Lamp Company. Officers and location of the factory remain unchanged. The company manufactures gas-filled lamps under license from the General Electric Company.

Crane Company Enlarges New York Works

The Crane Company, manufacturer of pipe, valves, fittings, steam fittings and so forth, is constructing a new one-story building, 100 ft. x 145 ft., adjoining its present works at 490 Cherry Street, New York City. The cost is estimated at $28,000. The new building will be used for assembling purposes and to provide storage space for material being held for export.

Trumbull Brings Out New and Revised Line of Switches

A new and revised line of externally operated entrance switches, two-pole and three-pole, 125 volts and 250 volts, for use with or without meter trims or back plate, has been brought out by the Trumbull Electric Manufacturing Company, Plainville, Conn. This, with the line of meter service switches announced a month or so ago, makes it possible to furnish an assortment to meet all requirements for 30-amp. entrance switches.

The new line replaces four members of top hinged entrance switches and boxes known as 5,741-43-51-53 and completes the 5,791 side-hinged line.

Consolidated Company Acquires Chicago Selling Agency

The Consolidated Electric Lamp Company, Inc., Danvers, Mass., has acquired the business of the Chicago Electric Lamp Company and will conduct its business of lamp distribution from the factory offices at Danvers.

Higher Selling Offsets Lower Manufacturing Costs

The August issue of *Royal Breezes*, published by the P. A. Geier Company of Cleveland, makers of the Royal electric cleaner, contains an analysis of price conditions by F. J. Gottron in which it is shown that the cost of appliance selling has increased more than the cost of appliance manufacturing has been reduced. Mr. Gottron suggests that as far as the public is concerned the small amount that might be saved by customers waiting for any reasonable price reduction is more than balanced by the time and labor lost through continuing wasteful methods of housekeeping.

Ansonia Electrical Company Expands Plant

The Ansonia (Conn.) Electrical Company has awarded to the Aberthaw Construction Company, Boston, a contract for the erection of three new factory buildings on the company's property on Division Street, Ansonia. The new buildings will be mainly one story in height and will add about 54,000 sq.ft. to the present facilities of the company. They will be of brick and steel construction and will consist of a 300-ft. x 75-ft. shop for the manufacture of magnet wire, a 190-ft. x 60-ft. shipping and stock house, and a 140-ft. x 75-ft. enameling wire building. A 40-ft. x 21-ft. steam plant building is also included. It is estimated that an increase in output of 40 to 50 per cent will be feasible through the completion of these buildings.

Republic Electric Enlarging Plant

The Republic Electric Company, Cleveland, wholesale distributer of electrical supplies, is reconstructing and adding to its present quarters. The portion of the building fronting on Chester Avenue will have three stories, which will contain its new offices, accounting department and salesroom. Additional floor space is also being added in the rear. When all improvements are completed (about Jan. 1) the floor space will be increased by 10,000 sq.ft., making a total floor space of 60,000 sq.ft. The location will then be known as Chester Avenue, corner of Eighteenth.

New York Appliance Business Picking Up

July billing by the New York office of the Edison Electric Appliance Company, according to W. B. Pierce, manager of the office, was a new record for the district. Ever since the beginning of the year New York billing from local stock has been on the increase. This, however, does not refer to billing from home office stock in Chicago. Larger business was booked and transacted last year, but much of this had to be shipped from Chicago stock.

Business is picking up, according to Mr. Pierce, who states that jobbers are ordering in better volume. Moreover, a most hopeful sign pointed out by Mr. Pierce is the greater rate of turnover by jobbers. From a turnover of three months last year jobbers, he said, are now moving heating appliances at the rate of eight to ten times a year.

First Annual Edition of "EMF Electrical Year Book" Issued

The first edition (1921) of the "EMF Electrical Year Book," issued by the Electrical Trade Publishing Company, Chicago, has made its appearance. The book contains 1,000 pages and comprises three leading features—compilations of facts and figures about each branch of the industry, definitions of electrical and allied terms, and a classification of products made and used by the industry with listings of their producers. All topics are entered alphabetically, the entire text being arranged as in an ecyclopedia or dictionary. In the products and manufacturers' directory feature there are included over 2,900 classifications and sub-classifications of electrical and related products, each of which is first descriptively defined and followed by the list of its American and Canadian manufacturers. It is planned to revise the book completely each year and to add to it each year further industrial information, definitions, products and manufacturers' listings.

French Railway Places Order with Westinghouse

An order for electrical equipment amounting to $1,200,000 has been received by the Westinghouse Electric International Company from the Midi Railway of France, which operates an extensive system starting from Bordeaux, running through Tolouse to Cette, with many branches. The section on which the electrical equipment will be used extends from Pau to Tolouse, in the Pyrenees Mountains near the Spanish border and has a total length of over 100 miles. The order includes transformers, synchronous condensers, lightning arresters and other substation equipment.

Moloch Company Occupying New Plant

The Moloch Company, Kaukauna, Wis., manufacturer of "Mayer" power hammers and "Moloch" automatic underfeed stokers, is now established in its new plant at Kaukauna, consisting of a machnie shop, 80 ft. x 200 ft., and a foundry of the same dimensions. The floor space and capacity of the plant have been increased by approximately 300 per cent. While at present, the company states, it has not as much work as it could handle, prospects are more than encouraging. The Moloch company is a consolidation of the Moloch Stoker Company of Chicago and the Kaukauna Machine Works of Kaukauna.

Drew Electric & Manufacturing Company Resumes Operations

The Drew Electric & Manufacturing Company, Cleveland, Ohio, has resumed operations after a brief shutdown, during which time its plant was rearranged and the company refinanced and reorganized.

James H. Drew continues in the capacity of president and director of sales, and Walter D. Healy as district sales representative. New officers of the company are Elmer F. Flynn, vice-president and general manager, and John D. Williams, secretary and treasurer.

The Drew plant has been operating at full capacity since reorganization on April 1, 1921, and is now again serving the trade and filling orders promptly on line material, motor bearings, pole sleeves, pole-line hardware and other specialties.

Multiple Storage Battery Corporation Expands

The Multiple Storage Battery Corporation, 350 Madison Avenue, New York City, was recently incorporated with a capitalization of $150,000 preferred stock, 5,000 shares of class A and 3,500 shares of class B non-par-value common stock. The new corporation has taken over the business of the Multiple

Storage Battery Company and is erecting a large addition which will quadruple the capacity of its plant at Jamaica, Long Island. Herbert G. Clapper, recently vice-president of the Eagle-Picher Lead Company, has been elected president, Norman D. Sturges remains vice-president and general manager and Jasper Bayne is secretary.

In addition to continuing the manufacture of storage batteries for automobile starting and lighting, for farm lighting systems and other purposes, the Multiple Storage Battery Corporation will shortly commence the manufacture of an electric vehicle battery upon which development work has been conducted for the past fourteen years. Details of the new battery, it was stated, will be available in the near future.

The incorporation of the new company with increased capitalization and the enlarged manufacturing facilities have been necessary to take care of additional business. Orders have been taken recently by this company for future delivery, it was stated to a representative of the ELECTRICAL WORLD, which would very nearly equal its business of the past year.

Columbian Bronze Corporation to Make "C-Y-C" Generators

The Columbian Bronze Corporation, 522 Fifth Avenue, New York City, has acquired the manufacturing and sales rights of Carlton, Young & Catlin, Inc., Grand Central Palace, New York City, manufacturer of "C-Y-C" generating units of 1.5 kw. capacity. The Columbian Bronze Corporation is proceeding with the manufacture of these units at its factory at Freeport, Long Island. Lewis J. Hall is president and W. H. Young is vice-president of the company.

Sun-Ray Company Names McCarthy Company New England Agents

The Sun-Ray Manufacturing Company, Oshkosh, Wis., manufacturer of electric heating pads, has appointed the A. F. McCarthy Company, 10 High Street, Boston its exclusive representative in New England. A new jobber's sheet has lately appeared on this product. The McCarthy company is an active sales representative for a number of socket appliances, rigid conduit, transformers and wiring material.

Walworth Locates Executive Offices in Down-Town Boston

The Walworth Manufacturing Company, Boston, has transferred its general and executive offices from its factory, at First and O Streets, South Boston, to 88 Pearl Street, Boston. The engineering department and works purchasing force will continue at the factory, but the company's main activities apart from production will now be directed from the new quarters, which are in close touch with the financial and machinery selling districts.

Delta Equipment Announces Partnership Dissolution

The Delta Equipment Company, 148 North Third Street, Philadelphia, dealer in steam and electrical power equipment, etc., announces that the partnership heretofore existing between Andrew I. Mehan, Peter J. McBride and George B. McClennen, under the name of the Delta Equipment Company, has been dissolved by mutual consent by the withdrawal of Andrew I. Mehan. The business will be continued by Peter J. McBride and George B. McClennen under the same name and at the same location.

Foreign Trade Notes

THE CONTINENTAL ELECTRIC COMPANY, LTD., has recently been organized to manufacture and sell "Royal" electric cleaners in Canada. The new company has its headquarters at 507-511 King Street East Toronto, Ont.

THE ELECTRIC APPLIANCE COMPANY, LTD., Winnipeg, Canada, has been reorganized under the name of the Wheaton Electric Company, Ltd. Mr. Wheaton of Saskatoon, who has been associated with George E. Miles as partner and manager, has taken over the ownership of the business and appointed H. E. Kelly as manager. During the past year Mr. Kelly has been associated with the Wheaton Electric Company, Ltd., at Saskatoon, in the capacity of manager of retail sales. Mr. George E. Miles has accepted the position of sales engineer for the Canadian Westinghouse Company, Ltd., with headquarters at Calgary, Canada.

POWER DEVELOPMENT AT VICTORIA FALLS.—The project to develop the water power of Victoria Falls on the Zambesi River, South Africa, has been revived, and it is exceedingly likely that the construction of a 250,000-hp. plant will soon be under way. It has been under discussion for many years, but the proximity of cheap coal stood in the way. This fuel is now at such a price that there is a demand for hydro-electric power. Electricity developed at the falls will probably be transmitted to the Rand mines, 600 miles distant.

INTERNATIONAL G.E. ACQUIRES BELGIAN LAMP COMPANY.—In the annual report of the Procédés Thomson-Houston & Carels, of Belgium, it is stated that the Belgian Thomson-Houston & Carels Company, through its agreement with the International General Electric Company, has obtained control over the patents for the manufacture of incandescent lamps in Belgium and was now engaged in establishing that branch of manufacture. For that purpose an interest had been acquired in the Manufacture Belge de Lampes Electriques.

GERMAN GOVERNMENT ACQUIRING ELECTRICAL WORKS. — The German Government has acquired the entire capital stock of several large electrical enterprises, it is reported from Switzerland, including the Electroworks Limited, the Central-German Power Works, the Brigitta Power Works, the Niederlausitz Power Works and the Sachsenburg Power Works and Coal Mines. The State will operate these enterprises under the title of Electroworks, Limited, with a full paid capital of 250,000,000 marks.

DEMAND FOR ELECTRICAL APPLIANCES IN CHINA.—Most of the larger electrical plants of China are intending an extension of their plants. According to a report from Peking, in a number of large Chinese cities the electric light leaves very much to be desired, which fact is chiefly due to the wear and tear of the machinery and the steady overwork the plants are obliged to perform.

REPORT OF BRITISH CABLE INDUSTRY.—In a report on the electrical cable industry in England, made by a subcommittee of the standing committee on trusts, it is stated that the prosperity of the industry is thought to be due largely to the efforts of the Cable Makers' Association, which by its organization and research initiated and has maintained a high standard quality of product. The report shows that in the prices quoted by association firms and non-association firms those quoted by the latter are generally lower by about 10 per cent. The percentage increase in the price of cables over pre-war prices is given as approximately 50 per cent in the case of certain cables for indoor use and approximately 100 per cent in the case of heavy underground cables. Comparing figures of early 1921 with those of the middle of 1914, copper increased 20 to 30 per cent, lead 30 to 50 per cent, steel wire 310 per cent, steel tape 410 per cent and paper 300 per cent. At the same time rubber decreased 50 per cent. Labor, however, one of the ruling factors determining cable prices, has increased approximately 200 per cent in this time.

MORE POWER FOR BERNE.—A powerful hydro-electric power station will be erected in the neighborhood of Oberhasle in the Swiss canton of Berne. The demand for electric current is steadily increasing not only for the electrified railroads and those to be electrified but also for light and industrial power purposes. It is expected that the Hasle power station will be ready for service in about six years. The Bernese Power Works is largely interested in the construction of the Hasle station. The supply of electric current for the light and power network of the canton of Berne rose from 132,366,514 kw.-hr. in 1919 to 151,699,868 kw.-hr. in 1920, an increase of about 15 per cent. Likewise increasing was the supply of electric energy for the railways, from 15,842,390 in 1919 to 23,178,920 kw.-hr. in 1920. New power stations will also be erected at Guttanen and at Innertkirchen.

INDUSTRIAL FAIR IN SWEDEN.—A large industrial fair will be held at Göteborg in Sweden in the near future. Special attention will be paid to electricity and nearly all electrical works of the country will exhibit their products.

ENLARGING STYRIA'S WATER POWER.—In order to exploit the water power in Styria, Austria, on a much larger scale than has hitherto been the case the Styrian Electric Works have just increased their capital from 20,000,000 to 600,000,000 crowns, and in addition new obligations to the amount of 300,000,000 crowns will be put forward. Work on the new power stations will soon be started.

THE SWISS FEDERAL COUNCIL some time ago decided on the installation of automatic telephone central stations at Geneva and Lausanne. Contracts for their construction have now been placed with the English Bell Company for the Geneva plant and with Siemens & Halske of Berlin for the installation at Lausanne. Both stations will cost about 6,000,000 francs. If those stations are giving good results their installation will be extended all over the country.

THE AMERICAN CHAMBER OF COMMERCE IN LONDON, 8 Waterloo Place, has issued a year book for 1921, in which are listed the names and addresses and business classification of about 1,000 American and British firms including electrical manufacturers interested in developing business between the two countries.

MANUFACTURE OF WIRE IN RUSSIA. —Work in connection with equipping the Northern railways of Russia for electrical operation has produced a large demand for small gage wire, the reserves of which are very small in Russia at the present time. In order to increase the supply the cable factory in Petrograd has been re-equipped and put into operation. This factory has an output of nearly 10,000 lb. of wire per day.

PLANT FOR MANUFACTURE OF ELECTRICAL APPLIANCES AT SYDNEY, AUSTRALIA. — Work has been started, according to the *Empire Mail*, on the construction of a plant at Sydney, Australia for the manufacture of alternating-current motors of both constant and variable-speed types, single and polyphase. Works have also been established near Sydney by an English firm of switchgear manufacturers which, it is said, will be capable of handling all phases of switchgear work.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN INDIA. — Steps have been taken by the Government of Mysore, India, according to the *Empire Mail*, for a hydro-electric development at Gersoppa Falls which are 830 ft. high, the highest falls in India. The proposed plan provides for the construction of a dam about 120 ft. high, thus creating a reservoir with a capacity of about 42,000,000 cubic feet. It is proposed to erect a power house about 153 ft. below the bottom of the falls, so that a total drop of nearly 1,000 ft. would

be secured, which, it is estimated, would develop about 100,000 hp. The cost of the project is estimated at about £3,000 000 sterling.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Ireland (No. 35,275) desires to secure an agency for the sale of electrical goods, etc.

A mining company in Chile (No. 35,282) desires to secure catalogs illustrating mining machinery, oil engines, electrical machinery and appliances, etc.

A technical commission in Portugal (No. 35,284) desires to be placed in communication with firms in the United States engaged in undertakings such as the electrification of railways and transmission of electric power, and to secure literature and catalogs from manufacturers of material and accessories pertaining thereto.

New Apparatus and Publications

THE BEARDSLEE CHANDELIER MANUFACTURING COMPANY, Chicago, has recently published a sixteen-page catalog, No. G-S-1, containing illustrations of 126 different patterns of illuminating glassware and prices on 200 sizes.

CUT-OUT.—Schweitzer & Conrad, Inc., Chicago, have put on the market a new 2,200/6,600-volt primary fuse cut-out under the trade name "Type Ejector" cut-out. It is described in their bulletin 103-A.

BOILER SETTINGS.—The Green Engineering Company, East Chicago, Ind., has placed on the market its Green sidewall waterboxes for furnace settings.

POWDERED FUEL.—The Combustion Engineering Corporation, 43 Broad Street, New York City, has put out a forty-one-page pamphlet entitled "The Use of Powdered Fuel Under Steam Boilers."

HIGH-FREQUENCY METER.—The Jewell Electrical Instrument Company, Chicago, has developed and placed on the market a 6-in. thermocouple instrument to measure high-frequency currents, for use mainly in electro-therapeutic work.

INSTRUMENT.—The Jewell Electrical Instrument Company, Chicago, has placed on the market a miniature instrument for alternating-current work, which can be supplied either as a voltmeter or an ammeter.

INDEXES.—The General Electric Company, Schenectady, N. Y., has issued indexes to its descriptive bulletins and sheets and supply part bulletins, dated July, 1921.

STOKERS AND POWER HAMMERS.—The Moloch Company, Kaukauna, Wis., is dsitributing a booklet describing the "Moloch" stoker, type H. The company has also issued bulletins EG-1 and ABD-1, covering the "Mayer" power hammers for both belt and motor drive.

ELECTRIC LAMPS—A new standard price schedule book has been issued by the Hygrade Lamp Company, Salem, Mass., in which it describes and illustrates its different types of incandescent lamps.

SMALL TOOLS.—The Greenfield Tap & Die Corporation, Greenfield, Mass., is distributing catalog No. 46, covering its small tools and pipe tools.

SPOTLIGHTS.—The F. W. Wakefield Brass Company, Vermilion, Ohio, is distributing a leaflet covering its "Red Spot" line of spotlights. Attention is called to its most recent model, the Wakefield "Silver Lining" or inner shell.

RESISTANCE ALLOY.—The Electrical Alloy Company, Morristown, N. J., has issued a bulletin on "Karma," a pure nickel-chrome alloy for use in electric ranges, furnaces, ovens, etc., where extremely high and continuous temperatures are required.

GEARS.—A new product for manufacturing cloth gears known as "Textoil" has recently been developed by the General Electric Company, Schenectady, N. Y.

STEAM ENGINES.—The Fitchburg Steam Engine Company, Fitchburg, Mass., has issued a forty-page catalog covering its different types of steam engines.

BLOW TORCHES.—The Turner Brass Works, Sycamore, Ill., is distributing Bulletin No. 5 covering its "New Line" torches, and also a four-page leaflet describing the "Turner" gasoline-kerosene torch.

PLUG ATTACHMENT.—Robert J. Ward & Company, 203 South Thirteenth Street, Philadelphia, has recently developed and will soon place on the market a new device known as a "tassel plug" for placing at the bottom of a chandelier for a plug attachment, for use where an extra attachment is desired.

RESISTOR UNITS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has issued a booklet describing its "vitrohm" (vitreous enameled) resistor units.

New Incorporations

THE CONNER-KELTNER ELECTRIC COMPANY, Enid, Okla., has been chartered with a capital of $75,000 by C. L. Conner and Y. S. Keltner.

THE KENTUCKY POWER COMPANY, Brooksville, Ky., has been incorporated with a capital of $15,000 by Barret Waters, S. B. Water and A. B. Walker, all of Cincinnati.

THE MEMPHIS (IND.) ELECTRIC LIGHT & POWER COMPANY has been organized by L. C. Malott, P. R. Carr, R. G. Hostettler, Otis Mayfield and J. W. Carter, all of Memphis. The company plans to supply several small communities in the vicinity of Memphis with electricity for light, heat and power.

THE G. E. FIXTURE COMPANY, New York, N. Y., has been incorporated with a capital of $25,000 to manufacture gas and electric fixtures. The incorporators are H. Firman, J. N. Chamkin and J. Moscoff. H. Solomon, 332 Broadway, is attorney.

THE CRESCENT ELECTRIC COMPANY, Boston, Mass., has been organized to manufacture electrical specialties. John A. Rein, 722 Hyde Park Avenue, is interested in the company.

THE APEX CHANDELIER COMPANY, New York, N. Y., has been incorporated with a capital of $20,000 to manufacture electrical fixtures. The incorporators are H. Tepfer, L. C. Kurchenoff and L. Sacks, 50 Court Street, Brooklyn.

THE VANLUE (OHIO) ELECTRIC LIGHT COMPANY has been incorporated with a capital of $15,000 by Guy F. Burnap, Harry J. Morehart, J. J. Herman, J. M. Bright and E. L. Plotts.

THE BUFFALO (OKLA.) LIGHT & POWER COMPANY has been incorporated with a capital of $20,000 by E. H. George and S. R. Woodward.

THE WINTER HARBOR (ME.) LIGHT & POWER COMPANY has been organized with a capital of $5,000 to generate and distribute electricity and gas for heating, lighting and manufacturing in Winter Harbor. The directors are S. P. Wetherell, president, Philadelphia; Samuel J. Anderson, treasurer, Media, Pa., and George C. Blance, clerk, Winter Harbor, Me.

THE MODEL ELECTRIC MANUFACTURING COMPANY, Pittsburgh, Pa., has been incorporated with a capital of $25,000 to manufacture electrical products. T. H. Heuber, 1104 Bushton Avenue, is treasurer.

THE ELECTRO THERMO COMPANY, New York, N. Y., has been incorporated by C. C. Trautmann, W. L. Strauss and P. Becker. The company is capitalized at $100,000 and proposes to manufacture electrically operated washing machines. C. A. Oberwager, 233 Broadway, represents the company.

THE SEAMWELD EQUIPMENT COMPANY, 814 Winnebago Street, Milwaukee, Wis., has been formed to manufacture welding equipment, transformers and electrodes under the Fay patent. The directors of the company are Fred Pabst, president; Harry W. Marsh, vice-president and Treasurer; P. C. McNulty, Jr., vice-president and general manager, and Joseph W. Fay, vice-president and chief engineer.

THE GENERATOR CORPORATION, Poseyville, Ind., has been incorporated by Otto E. Caudell, Valentine Bender and U. M. Caudell, Evansville; E. D. Fletcher, P. H. Anyle, George Nix and Joseph L. Schafer, Poseyville. The company is capitalized at $100,000 and proposes to manufacture lighting plants, galvanized tanks, troughs and other farm equipment.

THE McFARLAND-CLUM CORPORATION, Brooklyn, N. Y., has been incorporated with a capital of $75,000 to manufacture electric devices for automobiles and similar products. The incorporators are G. T. McFarland, R. V. Clum and J. G. Snyder, 256 Broadway.

Record of Electrical Patents

Notes on United States Patents

(Issued July 19, 1921)

1,385,090. RADIO-RECEIVING SYSTEM; John Mills, Wyoming, N. J. App. filed Feb. 19, 1916. Apparatus for neutralizing effect of impulsive disturbances.

1,385,091. SIGNALING; John Mills, Wyoming, N. J. App. filed Sept. 25, 1916. For minimizing production of false signals.

1,385,100. CONTACT SHOE; Wellington B. Sullivan, Baltimore, Md. App. filed Oct. 25, 1919. Collectors for transmitting electrical energy to vehicles.

1,385,121. ARC-RADIO-OSCILLATION GENERATOR; Harold F. Elliott, Palo Alto, Cal. App. filed March 23, 1920. New construction and arrangement of electrodes.

1,385,151. ELECTRIC BATTERY AND METHOD OF PREPARING MANGANESE MATERIAL THEREFOR; Otto E. Ruhoff, Madison, Wis. App. filed Feb. 26, 1919. Depolarizing material of such character that battery will deliver maximum amount of energy.

1,385,170. METHOD OF AND MEANS FOR REGULATING A SYSTEM SUBJECT TO LARGE INTERMITTENT LOADS; Alfred Herz, Chicago, Ill. App. filed Nov. 26, 1915. For regulating constant-potential system of current distribution.

1,385,222. COMBINATION SPARK-PLUG-TESTING AND GAP-ADJUSTING DEVICE; Joseph C. Miller, North St. Paul, Minn. App. filed Jan. 16, 1920.

1,385,286. TELEPHONE; John S. Timmons, New York, N. Y. App. filed March 25, 1919. Receiver magnifies sound.

1,385,305. STORAGE-BATTERY ELECTROLYTE; Fred D. Cheney, Gypsum, Kan. App. filed March 21, 1921. Consisting of water, sulphuric acid and sodium phosphate.

1,385,347. AUTOMATIC TELEPHONE SYSTEM; John Wicks, Chicago, Ill. App. filed Feb. 4, 1918. Trunk line between operators in two exchanges.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME. — Arrangements have been made by the Central Maine Power Company to issue $3,000,000 in bonds for extensions, improvements, etc. Harvey D. Eaton, Waterville, is president.

FARMINGTON FALLS, ME.—The Public Utilities Commission has granted the Farmington Falls Company permission to purchase the local electric plant owned by George A. Weymouth.

CONCORD, N. H.—The city has voted to extend the lighting precinct of the city to the Hopkinton line.

MERRIMACK, N. H. — The Amoskeag Manufacturing Company is having surveys made of the recently acquired Moore's Falls in Merrimack to determine its power possibilities. The company contemplates the development of water power at Moore's Falls upon the completion of improvements now under way at Amoskeag Falls

MIDDLEBURY, VT. — The Middlebury Electric Company contemplates the installation of generators in its power plant.

GREAT BARRINGTON, MASS.—The Southern Berkshire Power & Light Company contemplates the construction of a dam on the Housatonic River to cost about $150,000.

MANSFIELD, MASS.—At a recent meeting of the Board of Selectmen and town manager it was voted to extend the lighting system on Pine, West, Gilbert and Balcom Streets to Greenwood Lake.

SOUTHWICK, MASS. — At a special town meeting held recently it was voted to make extensions to the electric lighting system.

WESTFIELD, MASS.—Steps have been taken to secure the extension of the street-lighting system from the end of Franklin Street to Lloyd's Hill.

PAWTUCKET, R. I.—A movement has been started by the retail merchants' division of the Chamber of Commerce to secure the installation of 63 street-lamps in the business section of the city. William K. Toole is chairman.

WOONSOCKET, R. I.—Extension of the ornamental lighting system on North Main Street from the railroad crossing to the end of the street is under consideration.

Middle Atlantic States

AMSTERDAM, N. Y. — The Fownes Brothers Company, 108 South Main Street, is considering the construction of a one-story addition to its power house, to cost about $15,000.

BUFFALO, N. Y.—The City Council has instructed Commissioner Graves to obtain estimates in connection with the establishment of a municipal electric power plant now being projected.

CANANDAIGUA, N. Y.—The proposition to install a lighting system in the business section of Main Street was carried at a recent special election.

CONCORD, N. Y.—Plans are being prepared by the Iroquois Utilities, Inc., City Bank Building, Syracuse, for the construction of an addition to its electric power plant at Concord. The company has applied to the Public Service Commission for permission to make the extension.

GLENS FALLS, N. Y.—The Adirondack Power & Light Corporation has been granted permission by the Public Service Commission to acquire the capital stock of the Glens Falls Gas & Electric Company, the Consolidated Light & Power Company, Whitehall, and the United Gas, Electric Light & Power Company of Fort Edward and Sandy Hill. These properties were formerly operated by the Utica Gas & Electric Company.

ROME, N. Y. — The commissioner of Public Works has granted petitions for the installation of 100-cp. electric lamps on Earl Street between Linden and Locust Streets and on Fifth Street near the East Rome playground.

TARRYTOWN, N. Y.—The installation of an ornamental lighting system on Lower Main Street is under consideration. The Weschester Lighting Company supplies electrical energy for the town.

WILLIAMSON, N. Y.—The Public Improvements Committee is considering the feasibility of replacing the carbon street-lamps now in use with 32-cp. lamps with reflectors.

BUTLER, N. J. — The Public Utilities Commission has authorized an issue of $10,000 in bonds, the proceeds to be used for alterations and extensions to the municipal electric lighting plant.

JERSEY CITY, N. J.—Swift & Company, 154 Ninth Street, are considering the construction of an addition to the power house at their local packing plant to cost about $25,000.

LINDEN, N. J.—The local works of the Warner-Quinlan Asphalt Company, 79 Wall Street, New York City, was badly damaged by fire recently, causing a loss of about $3,500,000. The machine shops, power plant, laboratory and other buildings were destroyed. The plant, it is understood, will be rebuilt. Charles Almquist is superintendent.

TRENTON, N. J.—The City Commission has approved recommendation in report submitted by Prof. C. E. Clewell for improvements to the street-lighting system in the center of the city and out-lying districts. The system installed in the Sixth and Eleventh Wards will be used.

VERONA, N. J.—The Essex Falls (N. J.) Water Company is considering the installation of an electrically-operated pump at its plant at Verona, also the construction of a 350,000-gal. reservoir.

WEST ORANGE, N. J. — Thomas A. Edison, Inc., it is reported, is considering the construction of an addition to its power house.

READING, PA.—Bonds to the amount of $125,000 have been sold by the Pennsylvania Edison Company, the proceeds to be used for improvements and extensions to its electric plant and system, etc.

WILKES-BARRE, PA. — The Wilkes-Barre Company is considering changing its system from direct-current operation to alternating current. New equipment, it is understood, will be required.

NEW CASTLE, DEL.—Reconstruction of the electric lighting system in New Castle is under consideration. The cost of the proposed improvements is estimated at about $10,000.

WHEELING, W. VA. — The Wheeling Electric Company has purchased property on Sixteenth Street between Chapline and Eoff Streets.

ROANOKE, VA.—The Roanoke-Vinton Ice Company is considering the construction of a new ice-manufacturing and cold storage plant to cost about $100,000. T. B. Witt is manager.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until Aug. 12, Mare Island and Puget Sound, Schedule 8560—4,100 enclosed fuses of miscellaneous fuse element, 150 lb. insulating fibre, 500 link fuses, 100 lb. plate mica, 1,000 lb. attachment plugs, etc. Until Aug. 16, Mare Island, Schedule 8539—3,000 ft. steel conduit. Until Aug. 19, Puget Sound, Schedule 8564—electric cable and lamp cord.

North Central States

GUTHRIE, KY.—The Davidson Light & Power Company, Guthrie, recently organized, is installing distribution systems in Goodlettsville, Hendersonville and Madison, Tenn. A. F. Trimble is vice-president and general manager.

CARLISLE, IND.—The Knox and Sullivan Counties Light & Power Company, recently organized at Carlisle with a capital stock of $75,000 contemplates equipping a plant for furnishing electricity for heat and power. Murray Owen is interested in the company.

LOGANSPORT, IND. — Bids are being received by the City of Logansport until Aug. 10 for furnishing lamps, standards, conduits, wires, etc., necessary for the installation of a street-lighting system.

NEENAH, WIS.—The Valley Paper Mill Company, recently organized with a capital of $300,000, has engaged E. A. Wettengel, architect, Appleton, to prepare plans for the construction of a one- and two-story mill and power plant, 100 ft. x 300 ft., to cost with equipment, about $150,000. Albert C. Ehlman, 114 Grand Avenue, Milwaukee, is president.

ELIZABETH, MINN.—The Oscar Electric Company is considering the erection of an 11-mile transmission line to cost about $25,000. H. H. Haldorson is president.

HIBBING, MINN.—At a recent election the proposition to construct a new municipal power plant in Hibbing was carried.

EDINA, MO.—The Edina Light Company having recently completed lines to Baring, Novelty, Knox City and Hurdland, contemplates extensions to the system from Hurdland to Brashear and from the latter town to Gibbs. R. V. Bartow is president.

MONROE, S. D.—Bonds to the amount of $9,000 have been voted, the proceeds to be used to erect a high-tension transmission line to connect with the Bridgewater-Wall Lake line. The Northern States Power Company, Chicago, Ill., it is understood, will supply electricity for the proposed system.

ABILENE, KAN.—The Union Light and Power System, Abilene, and the Pawnee Power & Water Company, Larned, it is reported, has been consolidated under the name of the Union Light and Power System. In addition to supplying electricity to 103 towns the company, it is said, will supply current to many large ranches for irrigation purposes, etc.

Southern States

GREENVILLE, N. C.—The installation of an ornamental lighting system in Greenville is under consideration.

DONALDS, S. C.—The construction of an electric light plant in Donalds, to cost about $12,000 is under consideration.

PARIS, TENN.—The Louisville & Nashville Railroad Company, Louisville, Ky., it is reported, will start work immediately on the construction of an electrical power plant at Paris, Tenn. W. H. Courtenay is chief engineer.

WETUMPKA, ALA.—A company is being organized by E. G. Edwards and others to construct a cold storage and ice-manufacturing plant in Wetumpka, for which plans are being prepared.

POTEET, TEXAS.—A new company has been recently organized by C. C. Shotts and O. G. Barrow to install an electric lighting system. The plans provide for an initial installation of 1,250 kw.

Pacific and Mountain States

SPOKANE, WASH. — The Washington Water Power Company has applied to the Federal Power Commission for permission to develop power on the Columbia River at Kettle Falls in Stevens County. The project will be developed in three principal stages: First, a dam 35 ft. high will be constructed across the minor channel; second, a dam 69 ft. high across the main channel and the dam at the minor channel to be raised to 60 ft.; third, the two dams to be raised to a height of 75 ft. by adding gates to the crest of the concrete dam. The plans provide for the development of 153,000 hp.

CARMICHAEL, CAL.—The question of issuing $30,000 in bonds for the installation of an electric lighting system in Carmichael is under consideration.

FRESNO, CAL.—Surveys are being made for the remapping of the entire city for the installation of a more complete and modern lighting system. H. W. Stitt is city electrician. About 200 lamps, it is estimated, will be required.

LOS ANGELES, CAL.—The Los Angeles Railway Corporation contemplates the development of extensive improvements which include the establishment of four or five automatic substations, the first of which is under way and will be equipped with a 1,000-kw. synchronous convertor, costing $58,000; the construction of high-tension lines and additional feeder cable will cost an additional $20,000. The second unit includes a substation in the Garvanza district near Avenue Fifty-six and York Boulevard, to serve Eagle Rock Valley and the Garvanza line. G. J. Kuhrts is general manager.

LOS ANGELES, CAL. — Arrangements have been made for the installation of electric lamps on Rossmore Avenue and Van Nuys Boulevard.

SAN LEANDRO, CAL.—The question of installing an electric lighting system in the Broadmoor section is under consideration. The plans provide for 400 electroliers to cost about $60,000.

UKIAH, CAL. — The Snow Mountain Water & Power Company has made arrangements with Stone & Webster, contractors, for the completion of its dam across Eel River in Gravely Valley. The total cost of the dam is estimated at $1,500,000.

Canada

ALBION, TOWNSHIP, ONT. — The Hydro-Electric Power Commission of Ontario has submitted a report to W. A. Irwin, township clerk, relative to furnishing electricity for light and power service in the township.

DORCHESTER, ONT.—Plans are under consideration for the installation of a hydro lighting system in Dorchester with branch lines to supply power and light to the villages of Belmont and Harrietsville. For further information address S. Shaw, Dorchester.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 3-7.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Lake Placid, N. Y., Sept. 29-Oct. 1.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

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AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

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ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Chicago, Ill., Sept. 19-24.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

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CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 19, 20 and 21.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

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INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

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INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, Colorado Springs, Col., Sept. 6-10.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

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NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

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NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, New London, Conn., Sept. 6-9.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

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PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Pa., Sept. 7-10.

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SOCIETY FOR ELECTRICAL DEVELOPMENT, INC.. Assistant to the president, W. L. Goodwin, Guaranty Building, 522 5th Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Chattanooga, Tenn., Oct. 18 19 and 20.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403 4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

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